THE DYER'S HAND-BOOK

BY

F. J. BIRD

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THE DYER'S HAND-BOOK.

CONTAINING ABOUT 200 VALUABLE RECIPES

FOR

BLEACHING, DYEING, & FINISHING,

ON THE

MOST APPROVED PRINCIPLE;

WITH PATTERNS DYED FROM WHITE BY THE PROCESS GIVEN TO EACH.

BY F. J. BIRD.

The wise man liveth for to learn,
Then scatters knowledge in his turn;
Thus blessing as he goes along,
The anxious and inquiring throng.

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PREFACE.

While preparing this work for the trade, it has been the Author's conscientious endeavour to carry out both the letter and the spirit of the prospectus. Without at all encumbering the work, he has sought to embrace most, if not all, that is necessary to the garment dyer, in whose interest it is chiefly written. At the same time, there is perhaps no branch of the dyeing trade but may find within its pages something, at least, to repay its perusal and outlay. As a concise and handy book of reference, brought down to the present date, it cannot be other than useful.

If inadvertently any subject legitimately belonging to the dyeing or bleaching trade has not been touched upon, on receipt of a stamped directed envelope, the Author will have pleasure in replying to any reasonable inquiry at his earliest convenience. As to any new method that may arise, or any present one not legitimately within the scope of this work, he will have pleasure in giving such information as he may possess, or in obtaining the same, as far as possible, from reliable sources. In the latter case it would be necessary for him to make a small charge, probably from 1s. 6d. to 2s. 6d., to cover postages and expenses. Lengthened correspondence is not, however, invited.

So many inquiries have been already made to the Author for processes of black dyeing, that he has given much attention thereto, and hopes they will be found ample for all purposes.

Yours faithfully,

Stroud, Gloucestershire. F. J. BIRD.

March 31st, 1875.

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THE DYER'S HANDBOOK.

BLEACHING.

1.—Bleaching Jute.

For 50lb. of the material make up a solution of 5lb. of soda at 60°C, and draw it five times through ; then lift and rinse in clean water. To make up the chlorine bath, 2 1 – 2lb. chloride of lime are mixed with an equivalent quantity of the sulphate of magnesia and dissolved in cold water. The jute is steeped in this bath for three hours, and is then taken out, rinsed, and slightly blued with soluble indigo.

2.—Bleaching Linen. (100lb.)

Make up a boiling solution of 25lb. quicklime, and 12lb. soda ash. Let cool, enter the yarn, and let it steep without heat for 12 hours. Lift, rinse, and pass through weak sours (sulphuric acid), rinse again ; stir up 8lb. good chloride of lime in water, let settle, and enter the yarn. Let steep till perfectly white. Lift, rinse, and pass through weak muriatic acid sours. Dissolve 2lb. curd soap in boiling water, add as much ultramarine as may be required to give a blue tint; stir well together; enter the bleached yarn, lift, and dry.

3.—Bleaching.

In quantities of 100lb. The process is very simple. The scourer should have care that his kettle is not hotter than 132° F., and that the wool does not lie in the bath long enough to become yellow. The goods or yarn are scoured in clean soap, as usual, and then hung up in a closed chamber or bleach-house, exposed to the vapour of sulphurous acid, produced by burning in an iron pot, six or more pounds of brimstone. When yarn is bleached for the market, it should be put into the sulphur-house without the soap being rinsed out, only switched out well. If the white has to be coloured, the wool

should first be run through a cold bath, containing 2lb. of muriate of tin, 2oz. of extract of indigo, and 3oz. of cochineal paste. Red, blue, and yellow, form white, and the wool is naturally yellow; hence the method of treatment. Then take the wool into the sulphur-house. The fabric ought never to be coloured after sulphuring, as it will become spotted. Carpet yarn may be afterwards run through a bath containing 5lb. of whiting: this somewhat neutralises the offensive odour. Care should be taken in bleaching part cotton goods, when poles or slats are employed; the wood absorbs sulphuric acid, and will rot the cotton if in contact with the cloth.

The poles should be often washed or planed.

4.—Another method of Bleaching.

In the case of a large quantity of goods for printing, it is more convenient to bleach them in large vats filled with water, charged with sulphurous acid, as follows:—

Half fill a stone pot with pine sawdust, and cover it with a wooden cover, through which is a hole to receive a lead or glass pipe. Pour enough sulphuric acid to cover the sawdust, and insert the pipe which conducts the sulphurous acid gas into the vat of water, rendering the joint gas-tight by a luting of clay. To prevent too much free acid going over, the gas may be passed through a strong solution of soda, and then to the vat. The vat, of course, should be covered. The goods are thrown into the water over night, and when taken out will be found sufficiently bleached. This method when modified will be found advantageous in bleaching the whites of goods coloured chrome-black, should such a process be required. To each piece of fabric dissolve 1lb. of hyposulphate of soda in two pails of water, to which add 1lb. of sulphuric acid, the vessel containing the mixture being well covered, so as not to lose any sulphurous acid gas. All the sulphur must be allowed to settle until the liquid is clear, and the liquid may be then run into a clean tub filled with water. In this bath the goods are to be laid for six to eight hours, when the whites will be found perfectly bleached without injury to the black. Rinse and dry.

5.—Bleaching, Dyeing, &c., of Velvets, Velveteens, Fustians, &c., Black.

The proportions in the following are calculated for five pieces of cloth, the weight of which is about 40lb. each.

Bleaching.—The cloth must be put into the boiling-pan, which contains about 200 gallons of water, and 30lb. of soda-ash. It must boil from about three to four hours, afterwards it must be taken out and cuddled up in a cistern of clean water; from here run the cloth through chemic (bleaching liquor), standing about 2° Tw., then take it through a water-bath acidulated with muriatic acid, standing about $1\frac{1}{2}$° Tw.; the cloth must then be washed, and is then for most purposes ready for the dyehouse. But should it be required for dyeing light fancy shades, it is necessary that the cloth should go twice through the same bleaching process before it is ready for dyeing. In the following the method given is that generally adopted by the largest dyehouses in Lancashire for dyeing velvet, velveteens, cord, and fustians black.

Dyeing Black.—Before entering into the particular process it is well to remark that all the proportions given in this process are calculated for one piece, the weight of which varies from 30lb. to 40lb., and that the different mordanting and dyeing operations are generally performed in tubs holding about 50 gallons of liquor, which is the necessary quantity for dyeing one piece. The strength of the various liquors, if there is no other remark attached to it, is given according to Twaddle's hydrometer, while the wood liquors, as, for instance, sumach, logwood, &c., contain for every three gallons of water about 1lb. of wood.

Mordant.—Run the piece first through the slop-pan (boiling logwood liquor) then take off in a separate bath with alum and copperas; say, for both, about two quarts, each standing 6°. After which wash, and return to the slop-pan; from here the goods must be again taken off in a bath prepared by alum and copperas, to which three quarts of red liquor (sesquiacetate of alumina) are added, then wash.

Dyeing.—The well-washed goods must now be transferred to the logwood tubs, the liquor of which is nearly boiling, or as hot as the dyer can bear it, and which is prepared as above—for three gallons of water 1lb. of logwood, and in these logwood tubs the pieces must be winced for nearly half an hour.

Note.—It is generally calculated that it takes one dyer just one hour for entering, continually running backwards and forwards over the wince and cuddling two pieces.

From the logwood bath the piece must be brought to the taking-off tub, which is prepared with two quarts of alum, 6°,

two quarts of copperas, 6°, and three quarts of red liquor. From here the piece must be lifted out, washed, and returned to the logwood tub, and the same operation as just stated must be repeated. Afterwards the piece must be washed again, and returned again for the last time to the logwood tub, and then taken off in a bath prepared by four quarts of copperas, 6°, and washed. After washing, bring the piece into the sumach tubs, where it must be winced, &c., exactly in the same manner as in the logwood tubs, then taken off in water, to which four quarts of copperas solution has been previously added; then wash, and re-enter into the sumach tub, taking off again in a bath made up by two quarts of copperas, 6°, and two quarts of bluestone, standing about 8° ; afterwards wash in clean water.

Discharging and Stripping.—For stripping black velvets, &c., the following proportions are given for one piece :—The piece must be first boiled for about two hours in soda ash, and generally it is calculated to take for 100 gallons of water 30lb. of ash ; after the piece has been boiling long enough it must be lifted out and washed. Afterwards run through chemic (bleaching liquor) standing at Twaddle's hydrometer about 2° strong ; from the chemic, put it into a bath, to which spirits of salts is added, until the gauge glass shows $1\frac{1}{2}$° ; the temperature of this bath must be somewhere near 180° Fahr. ; from this acid bath the piece must be well washed, and is then ready for re-dyeing.

6.—Bleaching.

Mr. Kent, of Moscow, Russia, and of Nottingham, has patented an improvement in cleansing and bleaching, much used by cleaners working on a small scale. The improvement consists in subjecting the cotton yarn or fabric to the following process :—Lime and soda are mixed (in the proportion of about 2lb. of carbonate of soda to 1lb. of lime) with water, and allowed to stand to settle, when the clear liquor is drawn off or separated from the solid matters. It is found that the strength of the liquor when used should mark about $1\frac{1}{2}$ degrees of Twaddle's hydrometer. A strength of $1\frac{1}{2}$ degrees is found sufficient for fine light goods, and for heavier goods a greater strength is required. The yarn, thread, or fabric, or other preparation of vegetable fibres, is steeped in this liquor for from thirty to fifty minutes, more or less as the case may require. Fine goods require about thirty minutes, and stouter ones a longer time in proportion.

The process of cleaning and bleaching is then finished in the ordinary manner by washing, and then treating the fibrous materials with dilute sulphuric or hydrochloric acid and chloride of lime, but this part of the process requires less time, by reason of the fibrous materials not having been boiled for a great length of time with crude materials. A workman will readily judge of the effect produced, and he will find that it is not necessary to retain the yarns or fabrics in either of the liquors more than from forty to fifty minutes. By these means ordinary bleaching is accomplished in a few hours instead of occupying days. When the fabrics are to be dyed with madder, in order to render them suitable to be so dyed, or as it is commonly called "madder bleached," the fabrics after being steeped and prepared as explained, are boiled for two or three hours in a weak solution of carbonate of soda and resin. The greasy matters are formed by the lime into a sort of insoluble soap easily removed by the after process. "Souring" removes all excess of lime, and breaks up the insoluble lime soap; it still leaves the grease upon the cloth, but in such an altered state as to be easily removable by the subsequent "bowking." Hydrochloric acid is sometimes employed in this souring, but very dilute vitriol may be used. The hydrochloric acid sours are used cold and at a strength of 3° Twaddle. The bowking or boiling with alkali and soap dissolves and removes all grease and dirt from the cloth, leaving the cotton nearly pure. The alkali employed is soda ash; the soap is that made from prepared resin, and having the specific effect of improving the whites during the subsequent process of dyeing. The boiling need not be so long as the liming; the time required, however, depending upon the size of the kier and the number of pieces. The last process, that of passing through a clear solution of bleaching powder, destroys the slight buff or cream-coloured tinge still adhering to the cotton. The solution of bleaching powder is so weak that an ordinary sized piece of calico does not probably take up more than a quarter of an ounce of soluble matter contained in it. The goods are allowed to remain some time with the chloride of lime in them, and are finally passed through sours to complete the operation. The acid sets the chlorine free from the bleaching-powder, and completes the destruction of the colour, at the same time removing the lime and acting on any traces of iron that may be in the cloth. This souring should always be made with hydrochloric acid, as it obviates the danger of any sulphate of lime being

fixed in the fibres, or of giving bad whites in dyeing, effectually removes any iron, and leaves the goods softer. Tables of strengths and proportions of substances employed in bleaching are not of much value, since they must be modified according to circumstances, but as a kind of guide, or example, the following particulars may be quoted : For 14,000 yards of nine-eighths printing cloth, 66-reed, 250lb. of quick lime were used in the liming ; 110lb. of hydrochloric acid for the first souring, and 140lb. of soda-ash at 48 per cent alkali, and 80lb. of prepared resin, or resin soap made with resin, and caustic alkali, were used in the bowking. The last souring was sulphuric acid sour at 3° (37·4 F.) The quantity of bleaching powder was not ascertained, but the solution stood at 1° = 1·006 sp. gr. Chloride of lime is generally termed *chemick* in the dyehouse, and the solutions are made up to half a degree Twaddle, or 1·0025, but in some establishments this is increased to 5°. There is the danger of rotting the cloth when very strong chemick is employed, the process generally consisting in passing the articles rapidly through with the calender in order to saturate them, and then to pass them through the acid bath, the final operation being the washing. The calender renders the passage through the chemick very rapid, so that strong solution, even for fine goods, can be employed. The chemick must be clear, for any pieces or lumps of the chloride of lime coming into contact with the cloth would rot or *burn* it, as the term runs, leaving holes. The chloride of lime of commerce is a mixture of chloride of calcium and hypochlorite of lime. In the process of oxidising the foreign matters, which it is the purpose of bleaching to remove, the chloride is inefficacious, but the hypochlorite, under the influence of the water, or that of the carbonic acid of the air, sets free oxygen, in its turn rendering the colouring matter soluble ; the oxygen is separated according to the following equation :—

$$CaO, ClO = CaCl + O_2.$$

That is, one atom of hypochlorite of lime sets free two atoms of oxygen ; while one atom of free chlorine sets free only one atom of oxygen, according to the equation :—

$$Cl + HO = HCl + O.$$

We thus see that the mixture known by the name of chloride of lime contains only one-half of its chlorine in effective con-

dition. After the cloth has been passed through the liquors employed in the process of bleaching it becomes necessary to discharge the fluid, and this operation is effected by squeezing rollers or squeezers. These are rollers generally worked under steam-power, the upper one being caused to bear upon the cloth by its own weight, or by means of a weighted lever. There are many varieties of these machines, the description of which belongs, however, to mechanical engineering, and is not an essential of the chemical processes of bleaching. When squeezed, sometimes effected over rollers heated by steam, the cloth, if required for printing, needs no further operation; but if intended for the market, must be "finished," that is, starched and calendered. Many bleachers prefer to prepare their own starch from flour, as they thus avoid the drying process, for which the manufacturer of the starch must be paid. The starch is coloured with blue, generally ultramarine. It is disseminated over the cloth by means of rollers dipping into the starch, other rollers removing the excess. The starch need not be pure; fine clay or gypsum is sometimes employed as well. The pieces of cloth are occasionally artificially weighted with sulphate of varyta during the finishing, or with silicate of soda. The object of such an addition is to render the cloth solid in appearance. The calendering machine is really an ironing machine, surface and gloss being imparted to the cloth by means of heated rollers. The pieces when calendered and finished are subjected to hydraulic pressure.

7.—Bleaching Union Damask after Dyeing.

To 60 yards, take 1lb. chloride of lime, finely strained through a sieve into lukewarm water, handle the work well in for fifteen minutes or so, then lift, and add $\frac{1}{4}$lb. oil of vitrol, well stir and handle for ten minutes, lift and wash—the acid keeps it from running.

8.—To Bleach White Cloaks, &c.

Hydrochloric acid (spirits of salts) 6 lb., hydropro-sulphate of soda, 4lb. for one gallon of water, use enough to make the water tart; to be kept in stone jars for use.

9.—Bleaching Cotton Stockings with Turkey-red Tops.

Boil 100 dozens with 5lb. of soda and 4lb. of soap for several hours, then take them out and rinse. They should be

now entered in the bleaching-vat, which ought to be moderately strong. Handle the goods well, and let them lie in the liquor for a few hours, or until they are bleached enough; then take them out, allowing them to remain in the air as short time as possible. They should then be soured for half an hour, rinsed and scoured with soap. Inferior Turkey-red dyed goods need great care in bleaching.

10.—Bleaching Raw Cotton in small quantities.

If the same process were adopted as for stockings it would be tedious and expensive, but the bleaching of raw cotton on the small scale is easily effected by the following method :—

Boil the cotton in fresh water, without any lye or soda, only a few minutes, merely to saturate it. Long boiling would injure the fibre for spinning. Then pass the cotton into the bleaching-vat containing chloride of lime in such quantity as the operator may consider necessary. The cotton should be handled for fifteen minutes, then allowed to remain for four or five hours, afterwards being placed upon on an inclined board to allow the liquor to drain back. The cotton is now rinsed in small quantities, and to every rinsing add 1lb. of diluted sulphuric acid; stir the cotton in this sour for a few minutes, then let it off, and give the cotton a few more waters, so as to rinse all the acid away, then dry. The cotton will be quite white and easy to spin. The expense, inclusive of drying, will amount to about twopence per lb.

11.—The Continuous Process of Bleaching.

By all dyers and bleachers having extensive business the continuous process, sometimes known as the "new," the "Bentley," or "Pendleton" process, is generally adopted, effecting a considerable economy in time and labour. The process was first patented by David Bentley, of Pendleton, in 1828, and in principle consists in drawing the goods successively through all the bleaching solutions, the pieces being made continuous with the aid of the sewing machine. The following is a general outline of the operations: The pieces having been sewn together with the aid of a machine, are arranged in a carefully constructed rope-like coil, being generally drawn through an aperture of smooth glass or earthenware to impart this form. When the pieces have been singed they are drawn

into and boiled in the first kier, containing 1lb. of caustic lime to 14lb. of cloth. The kier is constructed to hold about 500 gallons, and the boiling is continued for thirteen hours. The pieces are next washed in the washing machine, and are then passed through a sour of hydrochloric acid at 2° Twaddle. Supposing 3,500lb. of cloth to be used, it is next bowked in a soda-ash and resin solution containing 170lb. of soda-ash to 30lb. of resin to 500 gallons of water. This boiling is continued for sixteen hours, and the goods are again washed. The cloth is next saturated with chemick or a solution of chloride of lime for two hours, the density of the solution being about $\frac{1}{2}$° Twaddle, when it is again washed. The continuous length is now boiled in a kier for five hours with 100lb. of crystals of carbonate of soda. After washing it is chemicked as before, then soured in hydrochloric acid of $2\frac{1}{2}$° Twaddle. The cloth is next allowed to drain, is washed until quite clean, squeezed between rollers, finally being dried over steam cylinders or by means of a hydro-extractor. To effect these operations in one continuous process, many improvements have been suggested upon the plan pursued originally by Bentley, of which the most important recently are those patented by Mr. Barlow in 1866. This inventor combines in one machine not only the various apparatus required for bleaching, but the operations successively of dyeing, printing, and sizing, subdividing the troughs or cisterns containing the mordants and the dyes by cross partitions, so that the several threads passing through the machine at the same time may be dyed in different colours or partly left uncoloured.

These machines are, however, not adapted to the bleaching of linen. Linen does not possess the elasticity of cotton, and the strain would either pull the cloth narrow or tear it.

11a.—Wool Bleach.

To every 100 kilos. of wool, placed in a large wooden vat, are added five kilos. of bisulphate of soda dissolved in water, and two kilos. of hydrochloric acid added. The well-washed wool is placed in this strong solution of sulphurous acid, and left five or six hours, being stirred or moved in the usual manner. The bleached wool is now put in the bluing bath, which also serves to rinse it. Woollen yarn can also be drawn through a solution of bisulphite of soda, and afterwards through dilute muriatic acid, which thus liberates free sulphurous acid.

DYEING.

12.—Pink on Silk or Cotton.

For 200 yards.	For 10 yards.
Bottoming, 2 gills Blue Archil.*	½oz.
Dyeing, 2½lb. Safflower.	2oz.
Raising, 10oz. Tartaric Acid.	½oz.

Put the archil into 100 gallons boiling water; winch in this 15 minutes; lift, bleed, then refine the safflower with cotton; make up a safflower liquor of 100 gallons; enter and winch 15 minutes; lift; put in half the raising; return and winch 10 minutes; lift again, and add the other half of the raising; return for ten minutes more; then wash in one water; harden with a little tartaric in another, and dry.

Rose colour may be made in this way by giving more stuff.

Steep the 2½lb. safflower all night in water; in the morning rub the cakes between the hands, so that it may be all broken; then put it into a bag or close sieve; stand with it under a good run of water until the particles are all disengaged from each other, and purged of all impurities; then put 20 or 30 gallons of water into a large tub, add ½lb. soda dissolved, and put in the safflower; stir it up, and let it bleed 30 or 40 minutes; then strain it through the bag into a second tub; if not well enough bled, repeat in the first tub with a little more soda.

To refine safflower, after being bled, immerse 3 or 4lb. cotton yarn or cloth in it; in 10 minutes lift, and add a little tartaric; return for 10 minutes; add a little tartaric again; return for 10 minutes more; lift and add the tartaric a third time, at which time it must do no more than taste slightly sour; then wash in two or three waters, after which it must be bled in a tub of clean water with a little soda; then make up this liquor with water for dyeing.

13.—Scarlet with Lac and Cochineal on Wool.

For 50lb.	For 1lb.
Boil 4½lb. Lac.	1½oz.
And 1¾lb. Bark.	½oz.
Add 2lb Tartar.	fully ½oz.
2 quarts Lac Scarlet Spirits.	2oz.

* There is no necessity for bottoming with archil, because as good, if not a superior pink, is made with safflower alone; and it is only given here to show how it is to be done.

Enter at 200° Fahrenheit; boil in this thirty minutes; lift, and wash well; then in a boiler of clean water

Boil 14oz. Cochineal.	¼oz.
And 14oz. Tartar.	¼oz.
Add 1½ pint Scarlet Spirits.	1¾oz.

Enter at 200° Fahrenheit; boil twenty minutes, and wash well out.

Sour like scarlet with cochineal (No. 15).

14.—Rose Colour on Wool.

For 40lb.

1lb. Cochineal.
3 gills Double Muriate of Tin.
1lb. Tartaric Acid.

Enter at 100° Fahrenheit; heat up; boil 15 minutes; lift and cool to 120° by throwing out part of the liquor, and filling up with water.

Add 1 gill Ammonia Paste.
12oz. Tartaric Acid.
6oz. Oxalic Acid.

Bring up to the boil; when the desired shade is got wash well and dry.

15.—Scarlet with Cochineal on Wool.

For 50lb.	For 1lb.
Boil 4lb. Cochineal.	1¼oz.
And 1¾lb. Bark.	½oz.
Add 3lb. Tartar.	Nearly 1oz.
Two quarts Scarlet Spirits.	2oz.

Enter at 200° Fahrenheit; boil one hour; wash well.

NOTE.—Sour before dyeing either cold or warm; one water out.

16.—Scarlet with Lac on Wool.

For 50lb.	For 1lb.
Boil 5½lb. Lac.	1¾oz.
And 1½lb. Bark.	½oz.
Add 3lb. Tartar.	1oz.
Two quarts Lac Scarlet Spirits.	2oz.

Enter at 200° Fahrenheit; boil one hour; wash well. Sour like scarlet with cochineal (No. 15).

17.—Saffronine Pink for 10lb. of Cotton Yarn.

Mordant the bleached yarn cold, with 2lb. of sugar of lead, 4° B strong, for half an hour, wring out, and bring it for half an hour on a quarter of a pound of Marseille soap, then dye at about 50° warm with saffronine. According to this method the pink will stand washing, and the influence of the atmosphere.

18.—Saffronine on Cotton.

Where sufficient space for drying is available, the following is a good method to use: The cotton is mordanted in a bath of acetate of alumina, standing 3° to 5° Baumé. To fix the mordant, the cotton is hung up to dry in the air for about twelve hours, and then rinsed. It is then dyed in a bath of saffronine, without the addition of acid or alkali.

To avoid the drying, proceed as follows: Pass the cotton first through a bath of sulphate of alumina of 10° Baumé. Mordant strongly in this bath, wring, and without rinsing place the cotton into a bath of sulphate of alumina, for the preparation of which see below.

After a few passages, rinse, and the cotton is ready for dyeing. But for greater safety and to ensure a bright and uniform colour, it is advisable to subject the cotton, after drying, to a second operation similar to the first, and then to dye with a saffronine bath on a soap bath which has been cut with a little acetic acid. If it is desired to obtain a ponceau, the cotton ought to be grounded with annatto before it is mordanted by either of the methods just described.

19.—To Dye Saffronine Pink on Velvets, Velveteens, and Calicoes.

Prepare your cloth with stannate of soda at 8° Twaddle, then scour at $1\frac{1}{2}$° Twaddle with vitriol, wash the cloth well in two or three cold waters, and then dye with saffronine, in a jigger, at 160° Fahrenheit. It will take about 1lb., or more, of saffronine, according to the shade you require. Work your cloth well, until all the colour is extracted, wash in cold water, and it is ready for finishing.

20.—Saffronine on Silk.

Dissolve in boiling water, to which a little carbonate of soda is added. Filter the solution, and dye on a bath of water at 100° to 195° F., to which some carbonate of soda is likewise added. Wash and clear the silk in cold water, acidulated with lemon juice or tartaric acid. To obtain a yellower shade, use a larger amount of carbonate of soda. If the silk takes the colour too rapidly, add a little soap water to the bath.

Preparation of the bath of sulphate of alumina, 10° B. Dissolve the sulphate of alumina in the water. As the sulphate of alumina of commerce always contains too little acid, it will be necessary to add some acid to the solution of carbonate of soda till the white flocculent precipitate formed re-dissolves again on agitating the liquid.

21.—Pink.

The new and simple way to Dye Cotton, or Cotton and Wool mixed.

Pattern 1.

To 12 yards of material or 1lb. of yarn take one ounce of aniline mordant dissolved in boiling water, handle the goods in this for 10 or 15 miuutes at hand heat, then dye in hand heat magenta bath. Use dye very sparingly to prevent the shade being too dark. Cotton and wool will be alike if not dyed too hot.

22.—Crimson on Cotton.

For 50lbs. of bleached yarn. Take the yarn through the liquor of 10lbs of boiled sumach ; next through the cold nitrate of tin mordant, thoroughly impregnating the yarn. Then pass it into a warm beck (140° F.), containing the boiled liquor of 15lb. of peachwood. After 20 minutes, rinse and dry.

23.—Ponceau on Wool.

For 50lb.	For 1lb.
4lb. Cochineal.	1¼oz.
1lb. Bark.	Fully 5 drachms.
2lb. Tartar.	Nearly 1oz.
2 quarts Scarlet Spirits.	2oz.

Enter at 200° Fahrenheit; boil one hour and wash well. Sour like scarlet with cochineal (No. 15). A fine colour, but probably not permanent, may be got from aniline ponceau.

24.—Limawood Crimson on Wool.

For 50lbs.

Prepare with 2lbs. Alum and ½lb. Tartar.
Boil half an hour; wash in three warm waters.
Boil 11lbs. Limawood.
And add ½lb. Cudbear.

Boil in this for half an hour and blue with warm water.

25.—Fast Crimson on Wool.

For 50lb.

6¼lb. Cochineal.
½lb. Cudbear.

Boil in this three quarters of an hour; raise with 2 quarts crimson spirits; boil a quarter of an hour, lift, wash well, and dry.

26.—Cochineal Crimson on Wool.

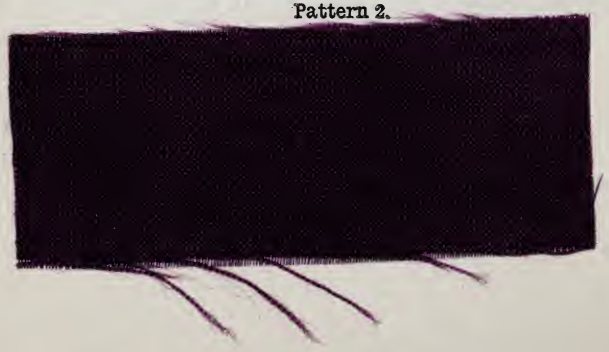
For 50lb.

3½lb. Cochineal or 3lb. Crimson Powder.
2½lb. Tartar.
2 quarts Crimson Spirits.

Boil half an hour; wash well; blue with soda. If crimson powder is used no soda is required.

27.—Maroon for Cotton or Mixed Goods.

Pattern 2.



Same as pink (No. 21), only use stronger magenta bath, according to pattern. Heat about 150.

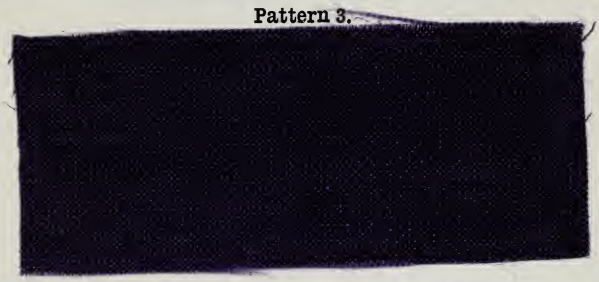
28.—Magenta on Jute.

For dyeing this colour the yarn does not require any mordant, but there are some dyers who prepare the jute in a similar way to that done on cotton, viz., sumac and stannate, or 1oz. of aniline mordant to the lb.

29.—Violet on Cotton or Mixed Goods.

The new and simple way.

Pattern 3.



To 12 yards of material, or 1lb. yarn, dissolve 1oz. aniline mordant in boiling water, and handle in for five or fifteen minutes, according to stoutness, then lift and drain, and without rinsing, or the use of stannate or tin, dye to pattern at good hand heat, but not boiled. Thus, wool and cotton are dyed at once.

30.—Magenta on Linen Yarn.

Prepare the yarn in 5lb. of olive oil, 11lb. of vitriol, 10lb. of water, 10lb. of methylated spirit, at about 60° F., and leave it in for about three hours; wring out and drain. Add to this liquor, then, $\frac{1}{4}$lb. of vitriol, draw the yarn about five times through this liquor, wring, and put it into a magenta bath, about 140° F.

31.—Fast Sanders Red for Linen Yarn (10lb).

Ground slightly with annatto; mordant by steeping over night in bichloride of tin at 8° B. Rinse, wring, and enter into a beck made up with 5lb. sanders to 100lb. of goods, and work at a boil for twenty minutes. Pass through sulphuric sours at $1\frac{1}{2}$° B., wring and rinse.

32.—Cochineal Red on Cotton.

For 10lb. yarn boil 1lb. best annatto with two-thirds of a pound of potash, run the solution through a hair sieve, and put the yarn into it, keep it middling hot, wring and take the yarn twice through a lukewarm water bath, wring, and put it into a solution of 2oz. of glue, to which $1\frac{1}{4}$oz. nitric acid has been added; keep it therein for a quarter of an hour, wring, and bring it on a tin; mordant 7—8° B., leave it in this mordant for half an hour, wring and dye with $1\frac{1}{4}$lb. of cochineal. The annatto and the mordant liquors are kept for future use. The cochineal bath may be used for scarlet dyeing on wool.

33.—Ponceau with Magenta on Cotton.

The following process is recommended for the production of a fine ponceau with magenta. The material—ten pounds of cotton yarn—is placed for a few hours in a boiling decoction of

$1\frac{1}{2}$lb. of Curcuma, and
$\frac{1}{2}$lb. of Good Sumac.

After opening and adding to the decoction from $\frac{1}{2}$lb. to $\frac{3}{4}$lb. of sulphuric acid, it is well stirred and left standing for an hour. After careful washing there remains a fine clear yellow upon the material. The yellow cotton is dyed in a warm decoction (from 10° to 15° F.) of yellow magenta, wound off and dried in a cold place. In place of sumac, flavin with circuma may be employed together. The colour, in this case, is still purer. By a third method, the yarn may first be dyed yellow with circuma and sulphuric acid, washed mordanted in a fresh bath with tannin, and dyed in a lukewarm bath of magenta. It is still better to dye in a perfectly cold bath of magenta. The colour is, in this case, clearer, but sometimes uneven. These three processes have proved to be excellent.

34.—Magenta on Cotton or Mixed Goods.

Pattern 4.

Same as pink (No. 21) only use stronger magenta bath, according to pattern.

35.—Fast Crimson on Wool.

	For 200 Yards.	For 10 Yards.
Bottoming,	2lb. Cudbear.	1½oz. fully.
Preparation,	1½lb. Tartar.	1¼oz.
	1½qt. Scarlet Spirits.	3½oz.
Dyeing,	2½lb. Cochineal.	2oz.

Boil or scald the cudbear; winch in this thirty minutes; then prepare and dye, like scarlet with cochineal (No. 15).

36.—Claret on Silk.

Prepare in a hot solution of alum for ten or twelve hours; lift and wash in two waters; boil or scald.

For 100 Yards.	For 10 Yards.
12½lb. Limawood.	1¼lb.
2lb. Logwood.	3¼oz.

Decant the clear of both liquors into a tub of sufficient size; enter, and winch for thirty minutes; air out and repeat; when dark enough, wash and dry.

NOTE.—In dyeing this, it ought to get two liquors, or the liquor at twice, as one will hardly make the colour as full as it ought to be.

37.—Claret on Cotton or Mixed Goods.

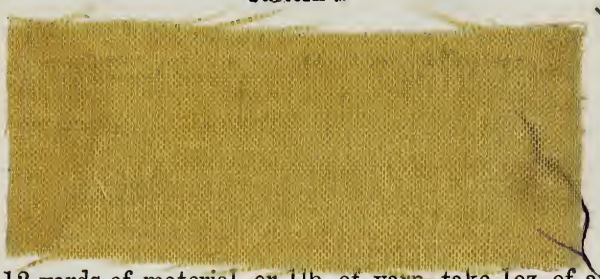
Pattern 5.

Same as Pink (No. 21), only after mordanting, run through sulphate of iron liquor (No. 168), well rinse in two or three waters either warm or cold, and dye in magenta bath. The iron liquor makes the difference between magenta and claret.

40.—Yellow.

The new and simple way to Dye Cotton, or Cotton and Wool mixed.

Pattern 7.



To 12 yards of material, or 1lb. of yarn, take 1oz. of analine mordant, dissolved in boiling water; handle the goods in this for ten or fifteen minutes at hand heat, dye in fustic liquor, and raise with alum or solution of tin. Magenta or ponceau on this ground will produce scarlet.

41.—Primrose on Silk.

For 200 yards.	For 10 yards.
1½lb. Barks.	1¼oz.
1 pint Muriate of Tin.	1½oz.

Scald the bark, decant the clear, add the muriate of tin; enter and winch fifteen minutes, then wash in two waters and dry.

42.—Yellow on Silk.

For 200 yards.	For 10 yards.
3lb. Barks.	2½oz.
1½ pint Muriate of Tin.	2oz., fully.

Done in the same manner as primrose. (No. 41.)

43.—Straw on Silk.

For 200 yards.	For 10 yards.
8oz. Annatto.	6½ drachms.
1½lb. Barks.	1¼oz.
1 pint Muriate of Tin	1½oz.

Give the annatto on the bottom 212° Fahr.; one water out, and then give the barks and muriate of tin same heat.

NOTE.—Before using annatto, it must be boiled with half its weight of American ashes in the least possible quantity of soft water. This note applies to every process where annatto is used.

44.—Straw on Wool.

For 50lb.

Boil 3¼lb. Bark and
3oz. Cochineal;
Add 2½lb. Tartar.
3 quarts Muriate of Tin.

Enter at 150° Fahrenheit; boil thirty minutes.

45.—Primrose on Wool.

For 50lbs.

Boil 2½lbs. Bark;
Add 2lbs. Tartar.
2 quarts Muriate of Tin.

Enter at 150° Fahrenheit; boil thirty minutes.

46.—Yellow on Wool.

For 40lb.

2½lb. Bark.
2lb. Tartar.
2 quarts Muriate of Tin.

Enter at 150° Fahrenheit; boil thirty minutes.

47.—Amber on Wool.

For 40lb.

Boil 4lb. Bark and
8oz. Madder.
Add 2 quarts Muriate of Tin.
1lb. Tartar.

Enter at 200° Fahrenheit; boil thirty minutes.

48.—Orange on Wool.

For 50lb.

Boil 10lb. Bark and
1½lb. Cochineal;
Add 2lb. Tartar and
2½ quarts Yellow Spirits.

Enter at 200° Fahrenheit; boil thirty minutes.

49.—Orange with Madder on Wool.

To 50lb. of yarn, bleached, add to the yellow kettle above—

1lb. of Flavine,
5lb. of Alum,
2lb. of Muriate of tin,
2oz. of Tin Crystals,
5lb. of Madder.

This kettle must be boiled for ten minutes, and then cooled to 170° F. The yarn is now to be entered, turning it quickly a few times to obtain evenness, then slowly for about fifteen minutes. It can then be removed, rinsed, and dried.

50.—Orange with Annatto on Silk.

This orange is brighter on linen than the one just described with madder, but the colour is not so fast.

For 50lb. of bleached yarn.

Boil 1lb. of annatto with 4lb. of soda-ash, pouring the whole into a kettle of hot water of 168° F. Enter the yarn and handle for fifteen minutes, rinse, and dry.

51.—Buff on Wool.

For 45lb.

Boil 4½lb. Fustic and 1½lb. Madder.
Add 7lb. Alum.

Enter at 200° Fahrenheit; boil thirty minutes.

52.—Giraffe on Wool.

40lb. Yarn or 90yds. Moreen.

Boil 9lb. Fustic, 1½lb. Madder, and 8oz. Cudbear.
Add 2oz. Alum.
1qt. Muriate of Tin.

Enter at 200° Fahrenheit; boil thirty minutes.

53.—Orange on Silk.

For 100 Yards.	For 10 Yards.
2¼lb. Annatto.	1¾oz.
1½lb. Bark.	1¼oz.
1 pint Muriate of Tin.	1½oz.

Give a good body of annatto, 212° Fahrenheit; wash in one water; then top with the bark and muriate of tin.

54.—Amber on Silk.

For 200 Yards.	For 10 Yards.
1¾lb. Annatto.	nearly 1½oz.
1½lb. Bark.	1¼oz.
1½ pints Muriate of Tin.	2oz.

Bottom with the annatto, and top with the bark and muriate of tin, same as orange (No. 53).

55.—Buff on Silk.

For 200 Yards.	For 10 Yards.
2lb. Annatto.	Fully 1½oz.
3 gills Vitriol.	1½oz.

Give the annatto at 212° Fahrenheit, when full enough lift, wash in two waters, then raise with the vitriol.

56.—Giraffe on Silk.

For 200 Yards.	For 10 Yards.
12oz. Annatto.	9½ drachms.
4lb. Fustic.	6½oz.
8oz. Madder.	6½ drachms.
4oz. Cudbear.	3¼ drachms.

Bottom with the annatto, 212° Fahrenheit, wash in one water, boil the fustic, madder, and cudbear together; put off the boil and enter; winch fifteen minutes; if not full enough, air out and repeat, then wash and dry.

57.—Salmon Colour on Silk.

For 200 Yards.	For 10 Yards.
1½lb. Annatto.	1¼oz.
5oz. Cudbear.	4 drachms.

Boil the annatto, then add the cudbear; put off the boil, enter and winch thirty minutes, wash in two waters, then dry.

58.—Chrome Orange Dyeing on Cotton.

The following method is employed to a large extent in the cotton warp trade as well as for dyeing on cotton. The proportions are for 20lb of cotton in the skein—small wood cisterns are made just sufficient to work 20lb. in comfortably, and which hold about 45 gallons (tubs are mostly used)—6lb. of

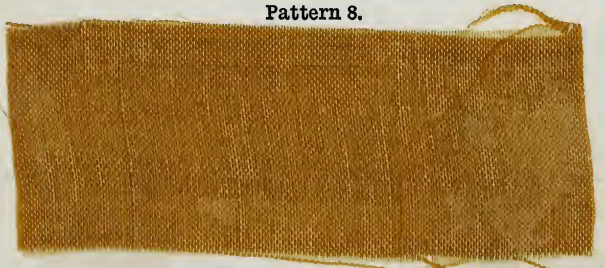
sugar of lead, and 6lb. of unslacked lime, pouring boiling water upon the lime, so as to boil itself to a pasty mass. This process of lime-scalding must be done in a small vessel, and having cold water ready to prevent a too powerful reaction, care being taken not to stop the boiling; this lime is then added to the sugar of lead bath, having the bath as cold as possible. Enter the cotton, give five turns, and put down all night; then lift, and keep the liquor for further use, when 4lb. of lime and 4lb. of lead should be added to the mother liquors to produce the required shade. After lifting out in the morning, wash in cold water and wring out, then cold water and one pint of vitriol, and wash off in several waters, and wring out. Then enter a boiling lime water, with 2lb. of chrome, if it should be streaky or uneven, another lime and chrome will give the desired result. In order to avoid this second lime it is customary, in some places, to have a deeper vessel for limeing, say a foot or more space between the bottom of the cotton and the bottom of the vessel, so as to put in unslacked lime, to make it stronger; then the chrome is added, and the whole is boiled and allowed to settle. When all is clear the cotton is entered and worked gently, so as not to disturb the sediment at the bottom.

When a good heavy shade is produced, care must be taken to have the sours washed well out before entering boiling lime and chrome; it is essential, also, to have the lime good.

In the Bradford trade many thousands of pounds of warp and skein are *steeped* every night.

59.—Aniline Orange on Wool, Silk, or Cotton.

Pattern 8.



Fields or Blackly orange yield good results on wool and silk; use sparingly at good heat with only an addition of acetic acid in small quantities.

For union damask it is preferable to flavine or other dye stuff in this respect, the cotton requires no bleaching.

60.—Aniline Orange on Cotton or Mixed Goods.

By bottoming with the aniline mordant and giving fustic and peachwood, raising with double tin, and then topping with orange, this will dye cotton or mixed goods.

61.—Orange on Black Cotton Warps.

For 50lb. of black wool with white warps, run 10lb. of the cloth at a time through a cold beck of 10lb. of acetate of lead, previously boiled for twenty minutes with 5lb. of litharge. Thence take each 10lb. through a cold weak lime bath, and again through a warm bath containing 10lb. of bichromate of potash. Again through weak lime water. In colouring orange on cotton, it should always be borne in mind that the fabric should not be taken directly from the lead beck into the chrome in order to prevent the occurrence of bleared stripes.

62.—Silver Drab on Velvets and Velveteens.

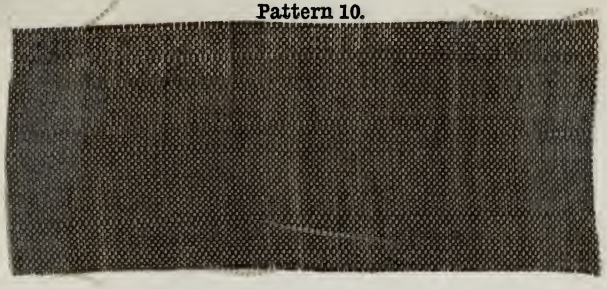
Give your bleached cloth a nice warm water, and sodden with two burns of fustic liquor and $1\frac{1}{2}$ burns of sumach, then dye with one noggin of pure aniline blue. If the cloth is worked in tubs, run your tub up with about 20 burns of water, work well, take off with copperas at 8° Twaddle, and one gill of pickle in clean water, then wash, and it is ready for finishing.

63.—Grey.

The new and simple way to Dye Cotton or Cotton and Wool mixed.

Pattern 9.

Pattern 10.



Pattern 11.

To 12 yards of material or 1lb. of yarn take 1oz. of aniline mordant dissolved in boiling water, handle the goods in this for 10 or 15 minutes, at hand heat, from mordant pass through sulphate of iron (see No. 168), rinse and finish. Any shade may be obtained in this way, from silver to slate.

64.—Drab on Silk.

For 100 Yards.	For 10 Yards.
Boil 4lb. Fustic, and	6½oz.
6oz. Logwood.	½oz. fully.
2½oz. Cudbear.	¼oz.
1¼oz. Copperas.	2 drachms fully.

Cool to 200° Fahrenheit; enter; winch 20 minutes; air out; repeat; then take a little of the liquor out of the boiler; dissolve the copperas; reduce it to handling heat with water, and give one or two shots through it as the pattern requires; one water out of the soddening; then give a warm, but weak sour, to clear the colour; wash in two waters and dry.

NOTE.—Before using cudbear, it must always be drenched with a little hot water, to the consistency of paste; then scald or boil it as occasion may require.

65.—Drab on Wool.

For 50lb.	For 1lb.
7lb. Fustic.	Fully 2oz.
8oz. Madder.	$2\frac{1}{2}$ drachms.
4oz. Cudbear.	$1\frac{1}{4}$ do.
2lb. Alum.	Fully $\frac{1}{2}$oz.
8oz. Tartar.	$2\frac{1}{2}$ drachms.

Enter between the cold and 160° Fahrenheit. After heating up, boil from ten to thirty minutes; wash in two waters. All dark shades of these colours may be slightly prepared with chrome; wash in two waters.

66.—Light Drab on Wool.

For 56lb.

4lb. Fustic.
$1\frac{3}{4}$lb. Alum.
4oz. Madder.
4oz. Tartar.
$3\frac{1}{2}$oz. Cudbear.

Same as drab (No. 65).

67.—Fawn on Wool.

For 50lb.

5lb. Fustic.
1lb. Madder.
$\frac{1}{2}$lb. Camwood.
$\frac{1}{2}$lb. Cudbear.
2lb. Alum.

Same as drab (No. 65).

68.—Stone on Wool.

For 50lb.	For 1lb.
1lb. Logwood.	5 drachms.
4oz. Fustic.	$1\frac{1}{4}$ „
8oz. Extract of Indigo.	$2\frac{1}{2}$ „
3lb. Alum.	nearly 1oz.
$1\frac{1}{2}$lb. Tartar.	$\frac{1}{2}$oz.

Same as Drab (No. 65).

69.—Lavender on Wool.

For 45lb.

Boil 2lb. Logwood and 2lb. Alum.
Add 10lb. Extract of Indigo.

Enter cold and bring up to the boil.

70.—French Grey on Wool.

For 50lb.

Boil 7lb. Fustic, and 12oz. Cudbear.
Add 6oz. Extract of Indigo.
1 pint Sulphuric Acid.

Cool to 180° Fahrenheit; enter, and boil twenty minutes.

71.—Silver-Grey on Wool.

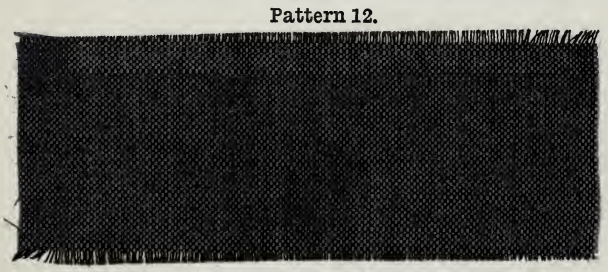
For 50lb.

Boil 1lb. Logwood and 2½lb. Alum.
Add 5oz. Extract of Indigo.

Brought on from 100° Fahrenheit; boil ten minutes.

72.—Slate on Cotton and Mixed Goods.

Pattern 12.



Same as Grey (No. 63) and repeat, or same as Grey, only with 1½oz. of mordant and a longer run through the sulphate of iron liquor. Top-off with serge blue to shade.

73.—Fawn on Silk.

For 100 Yards.	For 10 Yards.
4lb. Fustic.	6½ ozs.
5oz. Cudbear.	½ oz.
1½oz. Copperas.	1½ drachms.

Done in the same manner as drab (No. 64).

74.—Stone on Silk.

For 100 Yards.	For 10 Yards.
3lb. Fustic.	Nearly 5oz.
7½oz. Logwood.	¾oz.
2½oz. Cudbear.	¼oz.
2oz. Copperas.	Nearly ¼oz.

Done in the same manner as drab (No. 64).

75.—Slate on Silk.

For 100 Yards.	For 10 Yards.
8oz. Cudbear.	1 oz. nearly.
2lb. Logwood.	3 oz. 3 drachms.
1lb. Tartar.	1½ oz. fully.

Boil the cudbear in a copper, put off the boil, enter, winch for thirty minutes, lift; boil the logwood, decant into a tub of sufficient size, enter and winch in this for fifteen minutes; lift and raise with the tartar at once, then wash and dry.

76.—Slate on Wool.

For 50lb.

1lb. Logwood.
8oz. Extract Indigo.
4oz. Fustic.
2lb. Tartar.
2lb. Alum.

Same as drab (No. 65).

77.—Drab on Cords or Fustians, and Midshades.

Sadden the goods with 2½ burns of fustic, 1½ burns of sumach, 6 quarts of logwood, and 1 pint of annatto. Run your tub up to 20 burns of warm water. Work the piece well; then copperas with 4 quarts at 8° Twaddle, in warm water. Work the piece well; wash off in warm water with half a pot of pickle, and then they are ready for the drain.

78.—Dark Drab on Cords.

Sadden your cloth with 9 burns of fustic, 5 burns of sumach, 2 burns of logwood, and 3 pints of annatto. Work the piece

well, and then copperas in warm water with 4 quarts of copperas liquor at 8° Twaddle. Wash in two waters, add to the first water one pot of pickle, then sadden the same way as previously described, and copperas again. Afterwards wash off in warm water, to which one pot of pickle is added, after which they are ready for draining.

79.—**Drab.**

The new and simple way to Dye Cotton, or Cotton and Wool mixed.

Pattern 13.

Mordant as for grey (No. 63) dye in peachwood and fustic. Any shade can be got by regulating these two.

80.—**Brown, Light Shade.**

The new and simple way to Dye Cotton, or Cotton and Wool mixed.

Pattern 14.

To 12 yards of material, or 1lb. of yarn, take 1oz. of aniline mordant, dissolved in boiling water; handle the goods in this for ten or fifteen minutes at hand heat, dye in Bismarck.

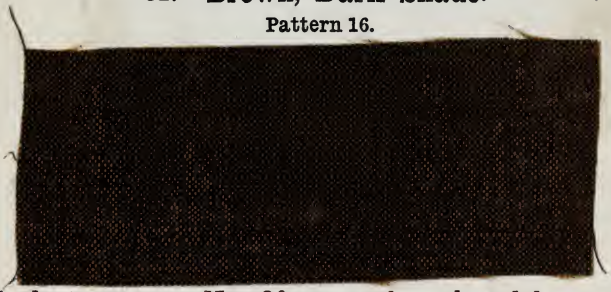
81.—Brown, a Darker Shade.

Pattern 15.

Same as No. 80, only pass the goods through sulphate of iron (No. 168), and rinse them before putting them in the Bismark dye-bath.

82.—Brown, Dark Shade.

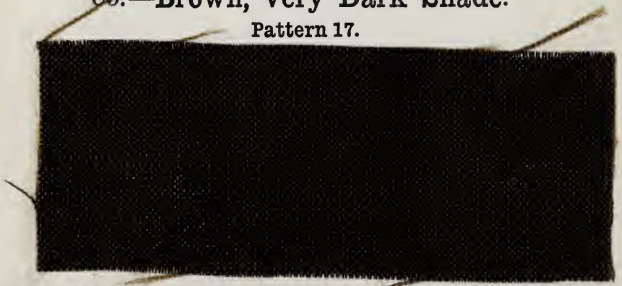
Pattern 16.



Mordant same as No. 80, pass through sulphate of iron (No. —) rinse, repeat in mordant and sulphate of iron in order to obtain depth of colour, rinse, and dye in Bismarck.

83.—Brown, very Dark Shade.

Pattern 17.



Same as No. 82, only pass through logwood liquor before dyeing in the Bismarck.

84.—A Fine Shade of Cure on Velvets and Velveteens.

Run your cloth through a jigger, set with cutch at 4° Twaddle, temperature about 180° Fahr.; give four ends through backwards and forwards, and run through chrome at 1½° Twaddle, take four ends through a jigger and wash in two waters. Sadden your cloth with three burns of fustic, six quarts of sumac liquor, and six quarts of redwood; work your piece well, and take off with one pint of alum at 8° and one quart of copperas at 10° Twaddle, in warm water; work well, and then wash in two waters; sadden with three burns of fustic, six quarts of sumac liquor, and six quarts of redwood; work your piece well, and then take off with one pint of alum at 8° Twaddle, and one quart of copperas, at 10° Twaddle, in warm water; work well, and wash in two waters. Get up a nice warm water, with one gill of annatto liquor, and work your piece well through this; it is then ready for the drain and for drying. This process will do very well for fine twills or fine calicoes, just as well as for velvets and velveteens. The same may be also applied to yarn with the difference, that yarn has to be worked in tubs.

85.—Cinnamon Brown on Silk.

For 100 Yards.	For 10 Yards.
Boil 12lb. Fustic.	1¼lb. nearly.
3lb. Ground Madder.	4¾oz.
2lb. Barwood.	3oz.

Cool to 200° Fahrenheit; then enter, and winch 20 minutes; air out, and repeat; then, with a little of the liquor in another dish, sadden to pattern with 4oz. or 5oz. copperas, one or two shots; then wash in two waters, and dry.

86.—Olive Brown on Wool.

For 50lb.

Preparation	1½lb. Chrome.
Dyeing	7lb. Fustic.
	3lb. Madder.
	1lb. Logwood.
	2lb. Tartar.
	8oz. Cudbear.

One run, raise in the second with 5 or 6oz. bluestone; wash well and dry.

87.—Common Dark Brown on Wool.

For 40lb.

3lb. Logwood.
12lb. Redwood.
6lb. Madder.

Boil half an hour, air out and repeat, then sadden with 1lb. Copperas. If too dark, raise to pattern with muriate of tin.

88.—Ruby on Wool.

For 50lb.

Preparation 3lb. Tartar and
2lb. Alum.

Boil half an hour, and wash in three warm waters.

Dyeing 8lb. Limawood
½lb. Cudbear and
¾lb. Tartar.

Boil half an hour, and blue to pattern with hot water.

89.—Olive Brown on Silk.

For 100 yards.	For 10 yards.
Boil 10lb. Fustic.	1lb.
2lb. Logwood.	3¼oz.
6oz. Cudbear.	2½oz.

Cool to 200° Fahrenheit; then enter, and winch for twenty minutes; air out; repeat; then sadden to pattern with 4ozs. copperas; wash and dry.

90.—Cinnamon Brown on Wool.

For 50lb.

8lb. Fustic.
2lb. Madder.
10oz. Cudbear.
1lb. Tartar.
2lb. Alum.

Give two runs and sadden with three or four ounces of copperas.

91.—French Brown on Wool.

For 50lb.

Preparation, 1½lb. Chrome.
Dyeing, 6lb. Fustic.
1lb. Ground Madder.
½lb. Cudbear.
1lb. Tartar, and if not dark enough,
Add 8oz. Logwood.

Boil half an hour.

92.—Claret on Wool.

For 50lb.

Preparation, 1½lb. Chrome.
Dyeing, 9lb. Limawood.
2lb. Logwood.
½lb. Tartar.

Boil half an hour.

93.—Brown on Black Velveteen (for Job Dyers).

Clean with hot sodawater, and rinse. Strip with chrome and common acid, rinse in two waters. Lay them down in strong cutch bath for two nights and a day, they will do a shorter time though not so well, rinse in one water, chrome them hot, and finish to shade with logwood and Bismark.

93a.—Cutch Brown, new way (for Job Dyers).

For Wool, Cotton, and Mixed Goods.

Dissolve about 20lb. cutch in boiling water, then add 8oz. bluestone. This will be found strong enough as a stock liquor to dye six or eight dresses in for six times with only the adding of 3oz. of bluestone each time, and then will do again by replenishing with cutch.

To Dye.—Put the dresses with most cotton in first, and so on, until they are all in, taking care that the heat is gradually raising all the time, but they need not boil; keep them in about one hour; lift them, and cool out, and while this has been doing, a second vessel of scalding water should be got ready, into which put 3oz. chrome. The dresses, without rinsing, will pass through this in the same order as before, for ten minutes each; then lift, cool, and wash, and in a third vessel have at

good hand heat a Bismark liquor ready to top them off in. About 2oz. of Bismark carefully dissolved will do for eight dresses; put in about 1oz. first, and add as you go on. Do one dress at a time. This will make good colours, and stand well.

94.—A New Mordant for Dyeing Aniline Blue on Cotton.

Prepare the cotton with double muriate of zinc, and, without washing, take it to the dye bath, which also contains a small quantity of muriate of zinc; then add to the bath gradually the aniline blue dissolved, and heat the bath gradually up to boiling point.

95.—Blue.

The new and simple way to Dye Cotton, or Cotton and Wool mixed.

Pattern 18.

To 12 yards of material, or 1lb. of yarn, take 1 ounce of aniline mordant dissolved in boiling water, handle the goods in this for 10 or 15 minutes at hand heat, pass through the usual quantity of well killed tin, then through a hand-heat bath of soluble blue of good strength. Not to be rinsed from this but passed through weak starch. If mixed goods, dye the wool first at boiling heat.

96.—Blue. Darker Shades.

Pattern 19.

Same as No. 95, but pass through logwood liquor before the soluble blue.

NOTE.—As these two blues are dyed strong the liquor may be kept for use.

97.—Blue. Very Light.

The new and simple way to Dye Cotton, or Cotton and Wool mixed.

Pattern 20.

To 12 yards of material, or 1lb. of yarn, take 1 ounce of aniline mordant dissolved in boiling water, handle the goods in this for 10 or 15 minutes at hand heat, pass through the usual quantity of well killed tin, let it lie in alkaline blue, either cold or hand heat, until the desired shade is attained. If mixtures of wool, dye the wool first.

98.—Process for producing Mill-fast Alkali Blue.

ON WOOL.

The introduction of alkali blue in cloth-dyeing has hitherto been prevented because of the running of the colour in the milling. A simple process has been discovered for remedying this defect. It consists in adding to the second, or acid bath, some sulphate of zinc, but in other respects working just as before. By using chemically-pure sulphate of zinc, the same beautiful tints are obtained as without this addition.

It has also been found that, with other aniline colours, an addition of sulphate of zinc to the dye-bath considerably increases its durability.

ON COTTON.

The mordant is made of 12oz. of tannin, 1oz. of tinsalt, and 1oz. of sulphate of copper, in which the articles (10lb.) are worked round for an hour, or steeped. They

are then placed in a hot bath containing 2oz. of alkali blue in solution, left for an hour, taken out, allowed to drain, unwound, and put into a fresh cold bath with just enough sulphuric acid to give it a distinctly acid taste. The tint is redder when the acid is added to the dye-bath and then washed.

99.—**Fast Blue for Wool** (10lb.)

Boil forty-five minutes with 2lb. alum, ½lb. argol, 2½ozs. chromate of potash, ¼oz. blue vitrol, and ½oz. tin crystals. Let cool in the liquor, and make up a fresh bath with 1½lb. of logwood. Boil for half an hour, cool, and bloom with ½lb. ammonia.

100.—**Process for Making Mordant for Gaslight Blue.**

Boil 30 gallons of water, with 30lb. of white sugar of lead, and 30lbs. of ground alum, for two hours, mixing very well; then add in small quantities 3lb. of carbonate of soda, until all are dissolved. Be very careful of the liquor boiling over. Let this settle, and when cold, make up a stock-tub, and work at about 7° Twaddle (No. 2); preserve the stock-tub for all aniline colour.

101.—**Process of Dyeing for the above.**

Bleach well, and then pass your yarns through mordant. Wring from this, and dry perfectly in stove without washing from mordant tub. When dry, wash yarns in hot water and wring up, then dissolve 4oz. of night blue in one gallon of spirit methylated, using about 1oz. of blue to 10lb. of yarns. Blue should be boiled in a tin for about one hour. Add this to dye-tub of cold water, enter yarns, three turns, lift, and add 1 pint of acetic acid for every 10lb. of yarns; then put in your steam-pipe, bring up your tub to the boiling point, turning over the yarns about every five minutes; the higher your temperature, the greener the tint of blue on the yarns, and more bloom. Wash from this in cold water well. This is a difficult colour to dye, but the above process dyes it successfully.

102.—**Topped Logwood Blue.**

Dip in the blue vat and then rinse. Boil the wool thus dipped for one hour in a kettle containing 10lb. of alum, 2lb.

of crude tartar, and 1½lb. of sulphate of copper. Remove and cool. To some fresh water add 5lb. to 10lb. of logwood (according to the shade required, and the quality of the logwood) in a bag. Boil, and then cool the kettle to 170° F. The wool may now be entered and handled slowly; in one hour it may be cooled, rinsed, and switched for drying.

103.—Indigo-Blue, part Logwood.

For 100lb. of cloth. Colour the cloth in the indigo-blue vat, and rinse well. Then boil the cloth in a bath of 20lb. of alum, 2lb. of tartar, 5lb. of pensée mordant, or purple acid, for two hours. Remove and cool. To a kettle of fresh water add 10lb. of logwood in a bag, boiling for half an hour. Cool to 170° F., and enter the wool, boiling half an hour. Cool and rinse.

104.—A Rich Permanent Blue with Indigo and Aniline.

Very fine shades of blue that will stand soaping may be dyed with serge blue, sold by Messrs. Brook, Simpson, and Spillar: it is simply worked on by acid, and stands boiling well. Any depth of colour may be got by adding indigo paste to it, or bottoming first with the vat. Moreover, this blue is very economical, being only 8s. or 9s. per pound.

105.—Soda or Potash Vat.

By boiling 10lb. of indigo in a solution of 4lb. of caustic soda, or potash, and adding 2lb. of feathered tin, or 3lb. of tin crystals, the indigo is deoxidised by the strong affinity of the tin for the oxygen. The ordinary method of fermentation is, however, to be preferred, as a large quantity of work can be got through. But the soda-vat is preferable for light blues, as a brighter colour is obtained than by the woad-vat, while larger quantities of goods may be coloured more easily. Potash should be employed for linen and cotton.

106.—A Decomposed Vat.

A decomposed, or, as it is termed, a "sick" or "green" vat may be known by its dark colour and freedom from odour, and more certainly by the addition of lime, bran, madder, and soda, or of woad. If, after several hours, the vat is restored, it may be worked with care as a new vat.

107.—Indigo Vat on Small Scale, for Woollen and Cotton Goods.

Have a strong 9gal. cask, put into it 8gal. of chamber-lye; have a 4qt. pickle-jar into which put 1lb. ground indigo, and 3 pints of best vinegar; put the jar in a saucepan, fill it with water, and make it boil well for two hours, well stirring it all the time. Then let it stand in a warm place three days; then pour it into the chamber-lye; rake it up twice a day for a month; it must be kept covered from the air.

108.—Blue on Woollens.

Woad.

Woad alone was used for colouring wool blue before indigo was introduced into Europe.

The introduction of indigo was a great advantage to the dyer, not only for its intrinsic value, but because he could daily strengthen his vat, using the old woad as a fermenting agent, like yeast in making bread. As to the practical value of the different varieties of indigo, it may be said that 4lb. of good Bengal are equivalent to 5lb. of good Guatemala indigo.

In order to colour with indigo, we have to deprive it of its oxygen. The deoxidised indigo is yellow, and in this state penetrates the woollen fibre; the more perfectly the indigo in a vat is deoxidised, the brighter and faster will be the colour. To a vat 8 feet deep by 6 feet wide, filled with water, and heated by steam or otherwise to 140° F., add 200lb. of woad, about 10lb. of well ground indigo,—or more according to the amount of work to be done,—5lb. of soda, ½ a bushel of good wheat bran, 10lb. of good madder, and 1lb. of flour. If the soda, bran, madder, and flour are boiled for five minutes before adding them to the vat, it will ferment twelve hours earlier than it would otherwise do. Stir the vat well, and after eight hours' rest, again stir. The vat by this time should have commenced to ferment, the liquid acquiring a mottled appearance.

When the fermentation is well establised, add about 2lb. of slaked lime, and again stir. If sufficient lime has been added, the surface of the vat will reflect a golden colour; and a sample of wool immersed in the liquid for about twenty minutes should become perfectly coloured blue in one minute. A green colour remaining with the wool after one minute shows that more lime must be added. Should this addition be neglected, the vat will

be, as it is technically termed, "lost." The lime added should be mixed with water, and the solution filtered. A vat, to which too much lime has been added, or which has become "oversharpened," acquires a brown colour, and the wool immersed in the liquor is imperfectly coloured a grey-blue. 2lb. or 3lb. of sulphuric acid may be added in such a case to form with the lime a neutral sulphate, which settles to the bottom of the vat.

After the addition of the sulphuric acid, a mixture of 5lb. of bran, and 5lb. of madder, boiled together should be added. Fermentation is thus again set up, and can be reduced by lime as before. When the vat is exhausted, and more indigo must be added, care should be taken that the liquor is sharp enough.

The liquor should again be warmed, and the indigo added, with about 6lb. of madder, 6lb. of bran, and 2lb. of soda, boiled together as before. The indigo should be added over night, in order that fermentation may be complete by the morning. In the morning lime must be added until the golden film forms on the surface of the liquid.

109.—Indigo Blue on Wool, for Topped Hosiery.

100lb. of wool are coloured with 4lb. of Guatemala, or 3lb. of Bengal indigo, in the woad or soda vat. There is then prepared, by boiling for a few minutes, 5lb. of cudbear, or 8lb. of orchil paste, adding to the mixture 1lb. of soda, or an equivalent quantity (about one pail) of urine. The beck must be cooled to 170° F. before the wool can be entered. It should be handled for twenty minutes, taken out, rinsed, and dried. 3oz. of aniline purple, dissolved in half a pint of alcohol, can be used instead of the cudbear. The shade produced is very pretty, but ought never to be used for mixed goods which have to be bleached, as it runs into whites. The cudbear, too, is affected by sulphuring.

110.—Dark Blue, for Wool for Broadcloth.

A healthy woad vat is employed for this colour. The wool is handled slowly for one hour, then removed. After two hours it can be again dipped until it has acquired the desired shade. Enough indigo should be added to the vat to colour the wool in three immersions, that is, about 10lb. of good indigo to 100lb. of wool. The wool may with advantage be taken through a warm bath containing 2lb. of sulphate of

copper. This additional immersion renders the colour faster in fulling. A dark blue, very common in the market, is topped with camwood or red sanders, the latter being boiled on the coloured wool.

110A.—Gloucestershire Indigo Vat.

Size : 5ft. over the top, 7ft. deep, and 6ft. to 7ft. at bottom.

To Make : Take ½cwt. bran, ¼ peck of lime, and 40lb. indigo. Warm up to 180° or 200°, rake it, or, in other words, stir it four times a day. If it ferments too much, add more lime; if not enough, more bran. An experienced eye or nose will soon tell when it is ripe or fit to use, which should be in about three days. Regulate strength of vat from time to time by the depth of colour required. No madder or woad is used when much permanency is wanted.

111.—On a New Method of Dyeing and Printing by means of Indigo.

By reason of its insolubility, alike in neutral and in alkaline solvents, the colouring matter of indigo cannot be fixed upon any textile fibre until it has been reduced; *i.e.*, converted into white indigo, which is soluble in alkalis and solutions of the alkaline earths. The energetic reducing properties of hydrosulphite of soda, and its almost instantaneous action upon indigo, which it converts into white indigo, in presence of an alkaline solution even at ordinary temperatures, have induced Messrs. Schutzenberger and Halande to examine the practical employment of this salt in the various applications of indigo in the arts of dyeing and printing.

The indigo vats most generally used in modern times are the sulphate of iron (green copperas) vat for vegetable fibres, and the fermenting vat for wool dyeing. The main defect of the copperas vat is the presence of a bulky sediment of oxide of iron and of sulphate of lime, which requires to subside before the clear portion of the liquid can be used for dyeing. The fermentation vat is difficult to work, and is subject to accidents or morbid changes which sometimes in the course of a few hours involve the entire loss of the indigo which they contain. (Such accidents are not unfrequently due to the malice of some workman, and are of course a kind of rattening.) The hydrosulphate vat which the authors propose in lieu of the present

methods, both for animal and vegetable fibres, is "set" as follows: Bisulphate of soda, marking 30° to 35° Beaumé (1·26° to 1·30° specific gravity) is put in a covered cask filled up to the surface with coils of sheet zinc or granulated zinc. This arrangement serves to increase the points of contact between the liquid and the metal. After standing for about an hour the liquid is drawn off into milk of lime, which precipitates the salts of zinc. The whole is well-stirred, and the clear liquid is separated either by filtration and pressure, or by decantation, water having been previously added. During all these operations air should be, as far as possible, excluded. If the hydrosulphate of soda thus obtained is mixed with ground indigo, and the amount of lime, or soda, needful to dissolve the reduced indigo, we immediately obtain a yellowish solution, which contains no insoluble matter except the earthy matters present in the indigo. By this process one kilo. of indigo may be reduced and dissolved in such a concentrated state that the liquid does not exceed 10 to 15 litres. In dyeing the beck is filled with water, a suitable amount of reduced indigo added, and the operation is performed in the cold for cotton, and at a hand heat for wool. The dye-liquid being clear for its entire depth the dyeing process can be conducted without loss of time. The excess of hydrosulphate present constantly reduces the scum of oxidised indigo which forms on the surface of the bath, and successive quantities of the concentrated solution of indigo are added from time to time as they are required. By means of this facility of keeping the vat at any degree of strength required, any shade may be produced with the least possible time and trouble. As regards cotton-dyeing the new process is distinguished for its ease and rapidity. In wool dyeing all risk of spoiling the indigo is avoided. Shades are produced at once, brighter and more solid than with the old vats, and it is easy to obtain upon wool bright blue bottoms, such as were formerly producible only by means of the sulphate of indigo, and which were of course much more fugitive.

In printing with indigo the process hitherto followed has been to use white indigo or indigotate of tin obtained by precipitating a tin vat, with hydrochloric acid, or by adding to the clear portion of a copperas vat a mixture of hydrochloric acid and salt of tin. This precipitate is thickened with gum and printed upon the calico. It is then fixed by treatment with milk of lime. The goods are then successively passed through bleaching

liquor, sulphuric acid, and a soap bath. The process is at once difficult, delicate, and expensive. It is only by constant and anxious attention that running and injuries to the accuracy of the design are avoided during the treatment with lime water, and only a very small fraction of the indigo is actually deposited upon the fibre. The numerous attempts hitherto made to replace the above-described process by some other means of fixing indigo have not proved successful. We need only mention as instances China blue, pencil blue, and printing with a concentrated indigo vat in an atmosphere of coal gas in order to exclude atmospheric oxygen. The new method (as tested by the authors upon a manufacturing scale) consists mainly in printing with an alkaline solution of dissolved indigo, suitably concentrated and thickened, the colour containing moreover a large excess of hydrosulphate of soda. The presence of this salt keeps the indigo blue constantly in a perfectly reduced state, which would otherwise become oxidised. It thus supersedes in a much more convenient manner the use of coal gas. The printing can be carried on in common air with ordinary machines. Oxidation is so little perceived that after an hour of working the colour remains reduced to yellow. On the other hand, by printing on dissolved indigo immediate fixation is secured, as the colouring matter is almost entirely utilised. Experience shows that with shades of equal depth solid blues are obtained at an expenditure of 50 to 60 per cent less indigo than with the old process. The shades obtained are more beautiful and solid, and the design comes out more distinct and better defined. The new blue not needing to be fixed by any subsequent process after printing can be applied simultaneously with the majority of other colours, such as aniline black, garaneine colours, whether obtained by dyeing or steaming, catechu, chrome colours, albumen colours, &c. Novel styles can be thus originated, which could scarcely be executed by any other process. The new colour is obtained by thickening with gum or any other suitable substance an alkaline solution of white indigo sufficiently concentrated, and adding to the mixture a sufficient quantity of hydrosulphite of soda. After printing the indigo is oxidised by hanging up the pieces for 12 to 14 hours. They are finally washed and soaped.

I find an application for a patent (3,407) for the same thing or certain hydrosulphates by Messrs. Holliday. Is it a new thing or only the old thing with hydro put to it? The effects

of hydrogen upon indigo, by means of zinc are well known, and have been worked out at some length with the alkalies and alkaline earths, and very dense solutions prepared and cotton and woollen dyed with it. Although not published, but used for their private trade, hydrosulphate appears to be derived from the new nomenclature called the French "systome." If zinc be added to a solution of indigo, it deoxidises, and cloth dyed with it is very fast. (See *Muspratt*, vol. 1, page 593.) Is not this an hydro when hydrogen displaces oxygen, and for sulphites and sulphides, alkalies, &c. (See *Muspratt*, vol. 1, page 592; see also *Gregory's Handbook of Organic Chemistry*, fourth edition, page 362), not to name Crum, Hofmann, and others. I applied to the firm for information as to the mode of applying their process to the dyeing of various fabrics, such as might be recommended by themselves, thinking it would benefit the trade generally, and also the firm as the vendors of the patent article. The following, however, is the answer sent me: "We are not in a position to give you any particulars of our indigo process just now to put in your book."

I have therefore given what information I could independently, and trust it may be none the less useful.

112.—Aniline Green for Jute Yarn. (45lb.)

Prepare hot, with 5lb. of sumach, for about one hour, and give afterwards mordant with 4lb. of alum, and 2½lb. of acetate of lead; leave it for a couple of hours, and then dye it warm with the previously dissolved aniline green.

113.—Aniline Green on Cotton.

Prepare with 5lb. sumach, and afterwards take it into 4lb. of alum, and 2½lbs. of acetate of lead; then wring, and dye warm with the previously dissolved aniline green.

114.—Iodine Green on Cotton or Mixed Goods.

Pattern 21.

Mordanted and dyed as violet No. 29, only use green instead of violet. If yellower shades are required after mordant, bottom in fustic raised with alum or tin. By this process any shade can be obtained in one dye on cotton and wool or silk mixed.

115.—Pea Green on Wool.

For 54lb.

2lb. Extract of Indigo.
7lb. Fustic.
1lb. Alum.

Bring on from the cold. When the boiler heats to 180° Fahrenheit put in the fustic; boil fifteen minutes.

116.—Common Pale Green on Wool.

For 50lb.

3½lb. Extract of Indigo.
2½lb. Fustic.
10oz. Tartar.
1 gill Sulphuric Acid.

Same as pea-green. Give the extract and acid first; when at 180° Fahrenheit put in the fustic and tartar; boil fifteen minutes.

117.—Grass Green on Wool.

For 50lb.

Boil 20lb. Fustic.
„ 7lb. Extract of Indigo.
„ 1½lb. Tartar.
„ 3 gills Sulphuric Acid.

Done in the same manner as above (No. 116).

118.—Picric Green, for 60 yards of Damask.

After cleaning goods should be soured off. This obviates the

necessity of adding acid to the dye-bath, as a consequence the picric will be better taken up.

Indigo past, 8oz.; picric, 2oz. Some prefer to give it the blue first, but my experience is, if the blue is given at twice it answers quite as well. It should be entered at hand heat, and well opened until it has exhausted all the blue, then lift, and add the other half, and boil in for fifteen or thirty minutes, lift, and wash in cold water made slightly acid. By regulating the blue and yellow any shade of green can be obtained. Silks can be dyed in the same way, only the heat must not be higher than 150° Fahrenheit, and they require drying quick.

Brighter and faster colours may be got by dyeing the silk Nicholson's blue first, and give picric after to pattern, but iodine, or for yellower shades iodine and picric, give the best results.

119.—Iodine Green.

On Silk.

The silk in hanks is dyed in one bath, which is composed half of water and half of the lye used in discharging the gum. The temperature has to be kept between 45° to 50° Centigrade. The woven silk is dyed at same temperature, but in a soap bath. The green colour is considerably brighter, if a little picric acid is added to the bath; but then no soap bath or lye must be used, as alkaline picric colours produce orange-coloured tints. The quantity of picric acid to be taken is about equal to that of the weight of the iodine green. In dying with the iodine green in crystals, the silk is first bottomed with this colour, and afterwards picric acid is added, then a small quantity of sulphuric acid is given to the bath as soon as the required shade has been obtained

It is dried without washing.

On Wool.

For 1 kilo. of wool, take about 10 grams of iodine green crystals, which will produce a medium shade. The green is dissolved in boiling water. Prepare a bath which contains for every kilo. of wool 100 grams of silicate of soda and 10 litres of water. Heat it until boiling, and add about one-third of the green solution; then enter with the wool, let draw slowly after some time (from 20 to 25 minutes); put the second third

of the solution to the bath, and after another 20 minutes, the remainder of it. It is well to exhaust the bath as thoroughly as possible. The wool will come out of this bath rather dirty and grey-looking. In order to spring it, it must be put as quickly as possible into water, acidulated with acetic acid. For 50 litres of water, 1 to 2 litres of acetic acid are generally calculated. Dry without washing It is recommended to give the wool before dyeing a light mordant of fustic.

Another method for dying green on wool, which is said to produce good results, is the following (the shade will not be quite so brilliant as the previous, but will enable the dyer to obtain darker shades). Boil 10 kilos. of wool for one hour, with half a kilo. of tin crystals dissolved in sufficient water. Let it remain in this mordant till cool. Wash and dye with 150 grams of iodine green; first add only half the dye-stuff, and then the other half, and after half an hour, add to the same bath 100 grams of picric acid, and 200 grams of sulphuric acid. Dye until the required shade is obtained and give it one wash.

On Cotton.

For 10 kilos. of cotton. Mordant with 2½kilos. of sumach. Wring, and pass through 30 litres of lukewarm water in which ½ kilo. of tin crystals has been previously dissolved. Wash after half an hour, and dye in the bath that contains the solution of iodine green. In finishing, add a very small quantity of acetic acid, and dry without washing. The dye bath must be kept at a temperature of from 50° to 60° The ground which sumach gives to the cotton dispenses with the use of any other yellow dyeing material, but should the shade not be as yellow as required, a decoction of quercitron may be given.

120.—Grass Green for Silk.

For 100yds.	For 10yds.
Boil 7½lb. Fustic.	12oz.
Add 2lb. Extract of Indigo.	3oz. 3 drachms.
2lb. Alum.	3oz. 3 ,,
1½ gill Sulphuric Acid.	1½oz.

Boil the fustic first; then add the extract of indigo, alum, and acid; put off the boil; enter and winch till you get the shade required; if not blue enough, give more extract of indigo; if not yellow enough, more fustic.

121.—Olive Green for Silk.

For 100yds.	For 10yds.
10lb. Fustic.	1lb.
2lb. Logwood.	3oz 3 drachms.
10oz. Camwood.	1oz.

Boil altogether for thirty minutes; put off the boil; enter and winch for twenty minutes; air out and repeat; sadden with three or four ounces of copperas in the same liquor, or with a little of the liquor in another dish; when the required shade is got, wash and dry.

122.—Pea Green for Silk.

For 100yds.	For 10yds.
10oz. Extract of Indigo.	1oz.
2½lb. Ebony.	4oz.
1lb. Alum.	1½oz.

Sour first; wash in one water; boil or scald the ebony; decant the clear into another dish, and add the extract of indigo and alum; enter in this, and winch for ten or fifteen minutes; wash in one water.

123.—Myrtle Green for Wool.

For 50lb.	For 1lb.
25lb Fustic.	½lb.
1¼lb. Camwood.	Nearly ½oz.
5lb. Extract of Indigo.	1½oz.
4lb. Alum.	1¼oz.
2 gills Sulphuric Acid.	⅓oz.

First boil the fustic and camwood well; then add the paste, alum, and acid; boil altogether a short time; enter and boil half an hour. If done at twice, give the extract and acid first, then in a clean boiler give the fustic, camwood, and alum; boil half an hour each time.

124.—Olive Green on Wool.

For 50lb.

Prepare with 1½lb. chrome; boil half an hour and wash in two waters, and then boil 12lb. fustic and 2½lb. logwood for

one hour. Enter, boil half an hour. Raise in the same liquor with 4oz. bluestone ; wash well and dry.

125.—Green upon Cotton.

Green upon cotton may be produced without aniline colours in various ways, but the brightness of iodine green is never obtained, but always shades far inferior to these colours; especially at night all these vegetable colours are mean looking and without any brilliancy in artificial light. The aniline greens, when used pure, become too dear for cotton and mixed wool, even in job dyeing. Hence, in many cases, it is well, in order to economise the dyeing material, to employ mixed processes for green, from which excellent results are obtained. It is best to apply the aniline green last, and to dye first a bright green by any one of the known processes. Before dyeing in the iodine green bath examine how far the previous process has succeeded, and act accordingly.

A fine green on cotton which is specially recommended for jobbing dyeing, is prepared in the following way :—

The goods are placed for a night in a decoction of sumach, mordanted, dried, and rinsed. They are then worked in a decoction of 10 kilos. of woad (to 10 kilos. of goods) for about an hour, left in it a little longer and dyed in

$\frac{1}{2}$ kilo. of indigo extract and
$\frac{1}{4}$ kilo. of alum.

They are then returned to the old sumach bath and dyed the next day in a bath of iodine green, which has already served for dyeing silk, but is no longer pure enough for it.

The goods may also be first blued in the vat, then dyed green in quercitron, and lastly with iodine green.

When chrome green is dyed over with aniline green the material is slightly uneven, but even in this case good results are often obtained by working very cautiously.

125A.—Cottons for Re-Black, Velveteens, &c., look well this way.

Let them be a night in sumac, rinse and pass for fifteen minutes through tar iron bath ; have ready two waters in one, put some whiting, pass through this first, afterwards the other,

and dye cold with logwood and fustic. To finish give them a boiling, starch water. They also do well the aniline mordant way, No. 127.

125B.—Black Silk Dyeing for Job Dyers.

All drab silks, and those that are likely to be sumached, are given a boiling, soda water, and rinsed in one water. Then pass them for a few minutes through boiling nitric acid bath, which gives them a yellow bottom, and at the same time strips off old colour. Rinse through two waters, one cold the other hot, and lay down in nitrate of iron bath for one night. Well rinse out of this in three waters, and pass through your decoction of logwood and soap to shade, finally pass them through a warm soap liquor to clear, and dry in a hot stove. The hotter they are dried the better they look.

126.—A New Mode for Dyeing Blacks.

This process is performed by pure nitrate of iron, basic, and neutral acetate of lead. Instructions respecting this new mode of dyeing are given in *Dingler's Journal* as follows :—

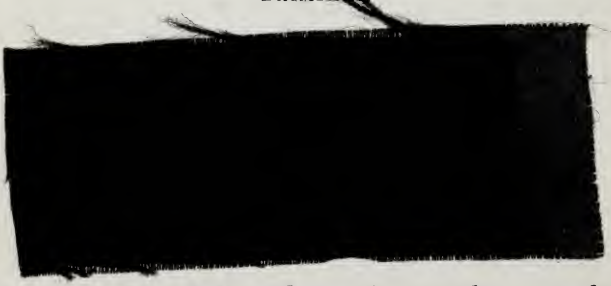
"The bath for the neutral acetate of lead is prepared by dissolving 20lb. of litharge (protoxide of lead) in 4lb. to 5lb. of pyroligneous acid, and as much water, until the clear liquor shows at (104° Fahr.) 44 to 45 Bé. scale. For neutral acetate of lead, it is only necessary to use a little more pyroligneous acid. For the preparation of nitrate of iron, new scrap-iron has to be dissolved in nitric acid. The silk which is to be dyed, after it has been previously well boiled and washed, is to be put into the bath containing the nitrate of iron, and worked about for fifteen minutes, then lifted out and exposed to the air for a short time to oxidise the iron, and afterwards washed in water, when the olive green colour changes into a rusty yellow. Treat the silk twice in exactly the same manner. Prepare a logwood bath, add to it a little quercitron or fustic liquor, heat it up to about 86° Fahr., and add to this a small quantity of blue vitriol (sulphate of copper) previously dissolved. In this bath the silk prepared with the iron is put, and worked from twenty to thirty minutes, until quite even, after which it should be allowed to remain in the bath for some time. The silk has now lost in weight, and has to be washed again in water, and afterwards to be put into a tub containing water, to which is added olive oil that has been

previously saponified with a little soda. In this liquor the silk is to be worked for a few minutes, after which it has to be well wrung, the object of this last bath being to give to the silk a nice soft feeling. The silk is then taken to a bath containing the basic acetate of lead, which has been heated to about 144° Fahr., in which it is well worked about, and left in for some time. This operation will give weight to the silk, but will rather weaken the appearance of the black. To reproduce the full brightness and purity of the black, the silk has to be lastly treated in the following manner : When it comes out of the basic acetate of lead bath it wants well wringing out, and, if possible, pressing, in order to free it as much as possible of liquor. This silk is then to be slowly dried at a gentle heat, in a close room in which there is a good supply of sulphide of hydrogen gas. When this process is carefully performed, it produces a most beautiful and soft black, and will be quite as fast as that which is produced from galls."

127.—Black.

The new and simple way to Dye Cotton, or Cotton and Wool mixed.

Pattern 22.



If wool, dye this first, and pass into a tub prepared with 4 parts of logwood and 1 of fustic, to which is added 1 ounce of scalded aniline mordant for every 12 yards of stuff, or 1lb. of yarn. Let it lie in this liquor all night, lift and sadden in 4 parts of copperas and 1 of bluestone or tar iron, rinse, if there should be any of them not on, repeat. In this way goods are both dyed and mordanted together, thus saving much time. Let fresh woods and mordant be added each time of using. Dyeing lukewarm is preferable. If cotton pieces they may be dyed hot in a much shorter time.

128.—**Fast Black on Wool.**

After the wool is thoroughly washed and cleaned, put it in a logwood bath—the stronger this bath is the better—and boil it for about one hour. Take the wool out, let it drain, and put it in a bichromate of potash bath, and keep it there for about five minutes, at a temperature of about 150° Fah. For shading it use quercitron, after which wash well in clean cold water. This black stands acids and alkalis, exposure to air, and also milling. I cannot give proper quantities, as the same have to be altered according to the kind of wool and water; but any practical dyer will soon find out the proper proportions.

129.—**New Aniline Black for Dyeing Woollens.**

Although aniline black for dyeing woollens has been tried repeatedly in this country, but has not up to the present been crowned with success, nevertheless it is well to mention the following process; but at the same time to say that though the colour produced by it is of a deep and very bright black, extremely fast, and stands without altering in the least its colour both in stoving and bleaching, it is feared its price at the present will be an obstacle to its general adoption; yet it is hoped that, with the continual and rapid improvements made in this particular branch of chemical science, this colour also will soon have its place in dyeing establishments: To dye 2lb. of wool, 3oz. of permanganate of potash and 4½ oz. of Epsom salts are to be dissolved in five gallons of hot water. When cool the wool is to be put into the liquor, and allowed to remain in it until it has taken up nearly all the colour of the dye-bath, or until the latter only looks slightly yellowish. The wool will partake of a dark brown colour; press, and, without washing, put it into a cold bath, prepared with 12oz. of aniline oil, 20oz. of spirits of salts, and two gallons of water. The wool will appear directly of a dark green colour; press, and wash it in water which contains a little soda; then it is to be put into a weak solution of bichromate of potash (one third of an ounce of bichromate for 2½ gallons of water), in which the wool will acquire a deep black colour. After this last bath wash and dry it.

Note.—The aniline bath must not be thrown away, but kept as a permanent vat, and needs only from time to time to be replaced by aniline oil, &c.

130.—A Bright and very Deep Black for Cotton.

In a sufficient quantity of water 8lb. of logwood extract and 1lb. of quercitron are to boiled for half an hour. In this liquor 1lb. of bluestone (sulphate of copper) is to be dissolved, and the yarn put into dye-bath hot, in which it is to be worked about, and left in it for about one hour; after which the temperature is to be raised to boiling point, in which the yarn is to be boiled for about half an hour longer. Prepare another bath, containing 1lb. of bichromate of potash, and $\frac{1}{4}$lb. stone salt; in this put the prepared yarn, work it well about, then let the yarn cool, and afterwards wash well in water. The liquor of the latter dye-bath must look a good brown colour, but should the same appear rather black, a small quantity of bluestone must then be added to it.

Another process for dyeing black, which also produces good results, is the following: Prepare a bath containing 1lb. of logwood extract, and 5oz. of fustic extract, which is sufficient for 10lb. of yarn. The yarn is to be boiled with this compound for about fifteen minutes, and left to stand over night; next morning the yarn is to be lifted out, wrung, put into a bath containing 4oz. bichromate of potash, and about 20oz. bluestone, and worked therein for about fifteen minutes: it is to be lifted out again, and wrung. To the above logwood bath, 2oz. of crystal soda are to be added, after which the yarn is put in and worked for about half an hour, and lifted out and wrung; and again put into the bichromate bath for fifteen minutes, to which are previously added $2\frac{1}{2}$oz. of copperas. The yarn is to be wrung as before, and, lastly, it is to be returned to the logwood bath, where it remains for half an hour. After being well saturated, it is to be lifted out, wrung, and dried without washing. To give this black a nice bright finish, it has to be passed once more through the logwood bath, to which has previously been added 1oz. of olive oil, mixed with half a quart of water, and 1oz. of soda-ash.

131.—Black (Cotton).

For 40 yards. Boil or scald 10lb. sumac. Lay the cloth or yarn in this for 18 hours, wring out, run through acetate of iron, 4° Twaddle, four turns, or for half an hour; wring out, repeat and wash well in three waters. Then boil 25lb. logwood and 3lb. of fustic; put off the boil and enter, or the clear of the

liquor may be decanted into another dish; one run, continue half an hour, wring out, repeat. Sadden with 1lb. copperas and ¼lb. bluestone, two runs; wash and dry.

In Job Dyeing, for a piece of cloth 20 yards, prepare a strong hot sumac, like the above, then put 3 quarts slaked lime into 20 gallons water. When the lime precipitates, decant the clear into another tub; lift the cloth out of the sumac, give one run through acetate of iron, one through lime, repeat in the iron, and again through the lime. Should the cloth have got unlevel, give an extra run through the lime to make it level; then wash in two waters, and give logwood and a little fustic, like the above.

132.—Aniline Black for Dyeing Cotton.

Three kilos. of iron are dissolved in 10lb. of water, and 10 kilos. of muriatic acid, the liquid diluted to 20° B, and the materials to be dyed placed in it for two hours. For 30 kilos. of material two solutions are prepared, the first consisting of 2,100 grammes kilos. of chlorate of potash and 30lb. of boiling water, the second of 3 kilos. of analine oil and 5 kilos. of muriatic acid. The two solutions are mixed, and the materials to be dyed dipped in till they are saturated. The impregnated materials are heated from three to five hours in a closed vessel, at first up to 30°, then to 50°, in a water bath. On removing from the vessel the black is fully developed. The materials are left lying together for a time, and then passed through a weak solution of chromate of potash, and then to soften them through a clean bath with oil. By passing the articles through very dilute sulphuric acid, washing and passing through weak alkaline water, a dark blue is obtained from the black.

133.—Black.

For 50lb. of yarn. Have in readiness a kettle containing 10 pails of logwood liquor, to which add 2lb. of blue vitriol and 2lb. of soda-ash. When these are dissolved, cool the kettle to 180° F., enter the dry yarn and handle it for 20 minutes. Then remove, rinse, and dry.

134.—Jet Black from Nitro-Sulphate of Iron for Silk.

For 200yds. or 16lb.* Prepare in a hot solution of nitro-sulphate of iron, 5° Twaddle, 150° Fahrenheit; work thirty

* A pound of silk woven into common sarsenet measures about 13 yards: this multiplied by 16 gives 208; or, for a more convenient standard, we may calculate 200 yards at 16lb., 100 at 8lb., and so on.

minutes in this, lift, and wash well in three warm waters. Then boil 18lb. of fustic, put off the boil, enter and winch for thirty minutes, lift. Boil 16lb. of logwood, put off the boil, and decant the clear liquor into a large tub, add 1lb. of white soap, enter, and winch for thirty or forty minutes in this, lift, wash in two waters, and you will have a brilliant jet black.

135.—Jet Black from Nitrate of Iron for Silk.

For 200 yards. After being cleaned, prepare in a cold solution of nitrate of iron 5° Twaddle,* thirty minutes in this, lift. Boil 14lb. of fustic, put off the boil, enter and winch thirty minutes, lift, wash in three waters bloodwarm. Then boil 16lb. of logwood, decant like jet black from nitro-sulphate of iron, give the same quantity of soap, and finish in the same way.

136.—Jet Black for Wool.

For 50lb. Prepare with 2¼lb. Chrome; boil half an hour, and wash in two waters. Dye with 20lb. logwood and 2lb. fustic. Boil half an hour; one water, then a slight sour, moderately warm; one cold water, and finish out of a warm one, softened with a little urine.

Note.—A pound of wool woven into common merino measures about 3 yards, common moreen about 2 yards.

137.—Fast Black for Wool.

For 50lb.

Prepare with 2lb. Chrome,
1lb. Tartar, and
1 quart Muriate of Tin; boil
1 hour, and wash in 2 waters.
Dye with 25lb. Logwood and
3lb. Fustic.

Boil thirty minutes, lift, add 1 pint of vitrol, return for ten minutes, then wash and dry.

138.—Fast Blue-Black for Wool.

Same as the previous receipt (fast black, No. 137), but without fustic.

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* This is strong enough for light silks, 4° or 4½° will do for dark and dipping silks.

139.—On Aniline Black.

It must not be thought that aniline black has a certain fixed composition, and that every aniline black after it has been fixed on the cloth possesses the same final composition.

This final composition, is, on the contrary, very changeable, on which account it gives so many different kinds of aniline black in respect of their properties, as some resist more or less the influence of light and of different chemical agents, others become green more or less easily in contact with air containing acid or sulphurous vapours.

The more intense an aniline black is the better it resists these different agents. This intensity, indeed, depends in part upon the concentration of the colours used ; but besides this there are other conditions which affect its purity.

A black which is developed in presence of an excess of aniline will always be purer than a black of the same concentration developed in presence of an excess of acid. Hence, it is always dangerous to use a black which is developed only in consequence of its acidity. Apart from the weakening of the texture which may be caused by it, a black colour is obtained which easily turns green and by no means bears the chlorine, which is a very great defect ; as in this case should the gas light contain only a little sulphur, the sulphurous acid formed by its combustion dyes the folds of all the pieces in a warehouse of a greenish colour.

With a colour containing an excess of base, on the other hand, a black is obtained less likely to turn green, and better able to bear the action of chlorine. In order that a black with excess of base may satisfy all requirements in a practical point of view, it must be developed with sufficient rapidity to avoid the escape of the aniline ; but this object is easily attained by using chlorate of aniline instead of chlorate of potash, as, by so doing, the quantity of aniline salt corresponding to the aniline in the chlorate is diminished.

The chlorate of potash is not easily decomposed in presence of an excess of aniline. In every aniline black which contains any chlorate salt, a chlorate of aniline must always be formed. The difference consists only in this, that many print-works produce the chlorate of aniline upon the cloth by a mixture of chlorate of potash and aniline salt, while others print it when already quite formed.

But it is clear that in the duration of the so-called oxidation of aniline black, there will be a gain in proportion as the reactions which take place on the cloth can be simplified.

Aniline black may be considered as the result of two totally different reactions:—(1) Decomposition of the chlorate of aniline. (2) Oxydation of the aniline salt, which is mixed up with the chlorated salt. By the decomposition of the chlorate of aniline, chlorinated products of aniline arise. Many degress of substitution may be thus formed which the difference of the results would explain. But besides these chlorinated products which make up only a portion of the present aniline black, another product is formed, which is the result of the oxydation of the aniline salt. Aniline black consists, therefore, of two blacks: the one formed by the chlorinated substitutions of aniline is very pure, and resists almost all chemical agents; but this is not so fine a black as that produced by the mixture of the two blacks, which attains its perfect brilliancy and effect only by the admixture of the second product, formed by the oxydation of the aniline salt. This second product has a dark violet blue colour, which in a sufficiently concentrated state is black; but it is much less pure than the former; it turns green with the smallest quantity of free acid; it completely resists the action of soap. These two blacks, the brown black and blue black mixed, form the present aniline black.

In order to obtain a fine black the mixture of the two shades must be so adjusted as to get at once the maximum of brilliancy, and the maximum of purity of which this mixture is capable. This depends upon the proportion of chlorated salt which the colour contains.

The experiments which gave the above results have been made with an aniline which contained toluidine and pseudo-toluidine. Experiments have also been made with pure aniline, and the same results obtained, and therefore the same theory may probably be admitted for the black of these three bases. Each of these three blacks consists of two essential parts; one formed by the chlorinated substitutions of the base, and one resulting from the oxydation of the salt of the same base.

140.—Dyeing Aniline Blacks on Cotton Yarn,

This process requires great care to prevent the blacks from becoming uneven and clouded. The cotton yarn, previously well

boiled out, receives seven turns in a bath composed of 200 grms. of sulphate of copper for every kilo. of material dissolved in water, slightly acidulated with hydrochloric acid. It is then well wrung out, Next it receives five turns at 50° C. in a bath containining 50 grms. hydrosulphate of soda per litre of water, and is next rinsed. It then receives seven turns in a bath of 10 litres of water, 180 grms. chlorate of potash, and 170 grms. of sal-ammoniac dissolved with the aid of heat, and then mixed with 480 grms. chloride of aniline. It is then stretched out very regularly in a hot drying room at 24° C. for forty-eight hours. It then receives four turns at 30° C. in a bath containing 1 grm. bichromate of potash per litre, and is well rinsed and dried. If the blacks have a reddish tone they may be passed through a bath containing 1 litre of bleaching liquor at 6° B. to 100 litres of cold water.

141.—**Another Black, a Fast Colour.**

For 50lb. of dry yarn. Soak the yarn overnight in a warm solution of 15lb. of sumac. The next morning remove the yarn, and pass it through a warm solution of 5lb. of copperas, 1lb. of blue vitriol, and 2lb. of whiting. Then handle it through a cold weak lye of lime-water; rinse the yarn, and again pass it through the sumac bath, to which has been added six pails of logwood liquor and 1lb. of boiled starch. The latter will precipitate all the dye-stuff upon the yarn, and a good black, perfectly fast, will be obtained.

142.—**Black for Linen** (40lb.)

The goods, perfectly cleansed, are steeped for an hour in a solution of 4lb. extract of logwood. Squeeze well, and pass eight times through a cold beck of 7½oz. bichrome, and ¾lb. blue vitriol. Squeeze, and dissolve in the old extract beck 1lb. copperas. Work for half an hour and rinse. To hinder the goods from smearing, pass finally through water containing a little gum.

143.—**Milling Black for Woollen Yarn** (100lb.)

Boil for an hour with 3½lb. chromate potash and 2½lb. red argol; rinse and dye with 50lb. logwood and 2lb. sulphuric acid, and rinse. Return it to the first beck, give four turns, and rinse again.

144.—Cleaning White Feathers.

First clean from greasy matter, then place the feathers in a dilute solution of bichromate of potassa, to which a small quantity of nitric acid has been added. The greenish deposit of chromic sesqui-oxide which ensues may be removed by weak sulphuric acid, when the feathers will be left perfectly white.

145.—Feather Dyeing.

In order to dye feathers they must previously be freed from fatty ingredients common to all feathers. This is done by means of a soda bath, which must be neither too hot nor too strong. After cleaning the feathers are all well rinsed in pure water, and when white they will take any colour.

146.—Black Feathers.

As feathers especially will not take a colour without previous mordanting, those intended for black must also be first mordanted. These mordants, even for black, may be of different kinds. Many dyers maintain that the feathers should be boiled with the mordant, but this is not necessary. The feathers are put into a strong nitrate of iron bath, at 15° B., left there for three hours, then rinsed out well, and afterwards dyed at a hand-heat with logwood and fustic; then the bath is coloured with bluestone till it appears greenish, and the feathers are left in it for three hours, with frequent stirrings, after which they are well rinsed and passed through a weak chlorine bath, which gives them a fine deep black and a glossy appearance. After the chlorine bath they are rinsed again and passed through a crude starch bath of unboiled starch, so that on drying they may not stick together. In this way all kinds of feathers are dyed black. The quantity of logwood and fustic for dyeing is regulated by the weight of the feathers. As a rule the quantity of logwood taken equals one-half, and of fustic one-fourth the weight of the feathers.

147.—Brown Feathers.

After the feathers are well cleaned they are placed over night in a cold, weak bath of sulphuric acid. The next morning a kettle of soft water is prepared, heated, and a little Marseilles soap put into it, but only just so much that when the bath is twirled round no scum, but only fat globules, appear on the surface. To this bath so much sulphuric acid is added

till it tastes sour. Then, in the same bath, to 1lb. of feathers is added ½lb. of circuma, and ⅜lb. of orcine, previously mixed with boiling water, and, according to the shades of sweetened indigo, the kettle is brought to the boiling point, and the feathers boiled in it. In this way various brown shades may be obtained by the addition of the above ingredients. After dyeing, the feathers are washed out in a basket passed through a weak, cold, sulphuric acid bath, and then starched with crude starch.

148.—**A Simple Way to Dye Feathers Brown.**

When clean, take ¼oz. aniline mordant to each feather, scald, lay them in for ten minutes or a quarter of an hour, then pass through iron liquor, then top off with Bismarck brown. For darker shades use logwood before or after the brown.

NOTE.—Feathers, as a rule, if dyed in the same manner as silks, will yield good results. They should always be got up out of crude (that is, starch simply put into cold water), as the plumes open better from this. They should then be taken and curled on their down side, not the back to be curled, so that when about every fourth plume is turned over from the upper side the down, or under side, should show up in rings up the centre of the feather. Now stem them, and they are finished. To those who are particular about their looking very nice, then my advice is, send them out to some man who does nothing else. Mr. John Taylor, 422, Rochdale Road, Manchester, is one of those whom I can confidently recommend. See his advt., page 95.

SUNDRY RECIPES.

150.—**The Application of Tannic Acid and Glue for fixing Aniline Colours.**

The fixing of aniline colours on vegetable fibres is far more difficult than fixing them on animal fibres, as, in the former case, mordants are always requisite, but in the latter they are mostly unnecessary, or of secondary importance. Wool is often more beautifully and vividly dyed with aniline colours, without mordanting, and the mordants are used chiefly either for the purpose of attaining a higher temperature in the dye-bath, or to give the dye-stuff greater permanency, but especially also to

avoid the unevenness which so easily occurs with aniline dyes upon wool.

Cotton and linen fibres will not combine with the tar colours without a mordanting medium, and it is necessary in all cases to look out for materials which are capable of rendering the soluble aniline dyes insoluble on the fibres. The series is by no means small, and it is only a question to decide which of the mordants used in practice is the most advantageous, and will yield at the same time the finest and cheapest colours. This question cannot well be decided by experiments on a small scale; it is only by operating with large quantities, and by manufacturing processes, that results are obtained which lead to a correct decision. The dyer in fine colours will, for the most part, have no opportunity to decide which is the most suitable method of fixing aniline colours upon cotton. In this question the productiveness of the bath employed must be well considered, and their value be deducted from the total cost in the calculation of the material used.

It would lead too far to discuss here the various methods of affixing aniline colours; they have nearly all been displaced by the method of mordanting with tannic acid, and as already many expert practical men have at this time decided that tannic acid is the medium to be preferred to all other mordants for dyeing with aniline colours on cotton, it is specially the case with magenta and aniline green (iodine green).

These two dyestuffs yield, with tannic acid, beautifully coloured and completely insoluble combinations, and thus tannin answers most fully the purpose of a genuine mordant. Tannin is, nevertheless, a tolerably expensive preparation, and consequently an effort should be made to find a substitute for it: a mordant which will either render it quite superfluous or admit of some economy in its use. The materials hitherto proposed—the oleic and stearic acids in soaps, &c.—do not satisfy the requirements, and it is not likely that a substitute will easily be found to displace tannin entirely. A long series of experiments on a large scale has led to the conviction that tannin (either pure or in sumach) is temporarily, at least, indispensable. On the other hand, tannic acid may be considerably economised by combining it with size before dyeing, and thus using tannin and size at the same time as a mordant. In order to produce, then, a certain tint with magenta or iodine green, or any other aniline colour,

far less tannin is required; in fact, the same result may be obtained with half the tannin which is obtained with double the quantity without the use of size. This result has been confirmed by a series of experiments made on a small scale, by employing weighed quantities of tannin with greater or less proportion of size. In the first place, the cotton was dipped in a tannic acid bath, then divided into two parts, the one drawn through a weak solution of size or gelatine, and the other dyed directly in a bath of known concentration at a certain temperature. The portion drawn through the solution of size was then dyed in a bath exactly similar, and the two samples were then compared.

The cotton mordanted with tannin and size was by far more fully and deeply dyed, and it may be affirmed that by using a size bath after the tannin bath, the latter may be used much weaker than when tannin alone is used for fixing the dye-stuff. In this way tannic acid may be economised to a considerable extent. By diluting the tannic solution more and more, and comparing the results with tannin and size, and with tannin alone, a point is reached in which both operations yield exactly the same shades. When this point is reached, by comparing the degree of concentration of both tannin baths, it may be determined what the saving in tannin has been. This depends much upon the quality of the tannin, so that the experiments have not yielded a result which could be reduced to figures. The samples of tannin obtained from different sources gave different results, and in one case, a greater saving could be effected with the use of the size bath, and in another, comparatively less. Evidently a combination takes place between the size and the tannic acid, which then acts on the dye-stuff of the aniline differently from the tannin alone.

151—Oil Mordant for Aniline Colours.

2kilos. of oil are agitated with 7½kilos. of alcohol; 7½kilos. of water are added, and ½kilo. sulphuric acid; the whole must be thoroughly mixed to an emulsion before use. In France, where alcohol is dear, the acid is added directly to the oil, then the water poured in, and the whole well agitated.

152.—Tannin as a Mordant, and how to make.

Tannin, as Dr. K. M. Kurtz observes in the *Würt Gwltt*, comes largely into the dyeing trade as a mordant for cotton,

union cloth, silk, mixed silk, artificial wool, &c., and justly so, for while the dyer, by using other tanning materials as sumach, galls, myrobolan, divi divi (articles of which the value varies according to the degree of maturity, the time of plucking, the method of drying, &c.) is compelled to crush, grind, powder, sift, boil, and filter them; tannin, which is a constant product of uniform composition, can be dissolved in water without further preparation. Tannin is certainly not cheaper (from 3s. to 4s. a pound); but much time, labour, and other incidental expenses are saved by its use, and it works cleaner. One pound of tannin represents the effect of about 40lbs. of sumach, 18lbs. of myrobolan, 14lbs. of divi divi, and 11lbs. of galls, besides which from five to seven per cent of dye-stuff is economised. Hence, it arises that upon tanned goods the colour comes out purer and brighter in an unequalled degree. Commercial tannin is now prepared chiefly from so-called Chinese and Japanese galls (from sumach). These are well-dried, converted in a stamping mill to the finest powder, which is then extracted four times systematically with a mixture of three or four times its weight of the best rectified alcohol and ether in small or large cylindrical vessels of tin plate, kept in agitation by hand or mechanical means. The alcoholic solution is then distilled off by steam in a copper retort, and the remaining tannin taken up in about double or three times the quantity of hot condensation water, and set aside for a day. There now separates a rather considerable quantity of a green, resinous body, insoluble in water, on the surface of the tannin solution, from which it is drawn off; if the solution is not clear, it may be passed through a charcoal filter. The solution is now evaporated in a double-cased boiler on the steam bath till the water is driven off. As a tannin solution in the air, particularly if hot, darkens strongly, the access of air is to be restricted as much as possible, and for this a copper vacuum apparatus is recommended. When the water is driven off the thick fluid tannin is poured into moulds of tinplate, where it is left to stiffen, after which it is powdered in the so-called indigo mills with cannon balls, and sifted, as it is usually required in commerce, as a fine powder, which quickly dissolves. The more ether is employed in the extraction of the galls in proportion to the alcohol the whiter the tannin is; alcohol alone dissolves a considerable amount of dye stuff. Water cannot be used for a first extract, as it dissolves too much dye and other foreign

substances, which cannot then be separated from the solution. For many technical purposes a tannin prepared alone with a spirit of high degree is as valuable as that prepared with alcoholic ether, to which a smell of ether obstinately adheres. The consumption of tannin, besides being largely used in pharmacy, in the wine and beer pathology, is at present very much on the increase, and its production is a very profitable branch of many a chemical manufactory. Many dyers combine with the employment of tannin that of so-called oil, or animal mordants (olein sulphate of ammonia), which give more fire to the colour, especially carmine, and thus lead to an economy of dyeing material. The preparation is simple: In a large dish, to about 60lb. of best cotton-seed oil are added 30lb. of English sulphuric acid, at 66° Bé., with gradual stirring; the mass becomes heated, evolves much sulphurous acid, and is stirred till it becomes quite homogeneous. When the mixture (the olein sulphuric acid) has cooled again, so much dilute spirit of ammonia is added, with continued stirring, that the remaining liquid smells of it, weighs about 5cwt., and presents a homogeneous, bright, yellow, soapy paste. But whether the above preparation, in proportion to its effect, will not become too dear, Dr. Kurtz will not decide.

153.—Mordant for Aniline Colours on Cotton,

Until recently aniline colours have been fixed on cotton by treatment with animal matter, as albumen, gelatine, or with galls, sumach, tannin, as well as by the use of mordants of acetate of alumina, soap, and oil. Dr. Reiman, however, directs attention to the peculiar power possessed by starch of abstracting aniline colours from solutions, this, not being due to the gluten it contains, since this property is shared equally by wheat and potato starch; and he founds upon this a beautiful method for fixing aniline colours on cotton. It is immaterial whether the colour is attracted by the starch suspended in the liquid or attached to the fibre. If the cotton is saturated with a thin paste of potato or wheat starch, and then steeped in a dye-bath of aniline colour, it will receive the corresponding shade.

154.—Aniline Colours—Mordants for.

"Many things have been introduced from time to time with more or less success to enable cotton goods to take up the colours quickly and brightly.

"The following are the various mordants and their results :—

"Sumac has always found more or less favour, and unquestionably it has its advantages. It is cheap ; the liquor can be turned to account for other purposes ; and most dyers know how to use it, and are afraid to discontinue its use in favour of a new thing of which they know but little.

"Stannate of Soda.—The principal advantage claimed for this is that it leaves the goods cleaner (whiter) than sumac. It does not require much, or indeed any rinsing. On the other hand, it is considered dearer than the former, and it does not stand exposure well. In articles of dress, garment dyers are often requested to retain black stripes and spots that may be in the goods, which stannate discharges in a great measure. It certainly rots the work to some extent.

"Methylated Spirit.—As this takes about fourpennyworth to about twelve yards of dress material, it is generally considered too dear, but it is clean, works tolerably even, and it retains stripes, spots, &c.

"Tannic Acid.—This unquestionably is superior to all the foregoing, and is applicable to all purposes where any of the former can be used, and in many instances where they would not avail. The chief argument against it is its price, though it is affirmed by some practical men, considering all things, to be as economical as either of the foregoing.

"Patent Aniline Mordant.—This differs from all the foregoing in several important respects. It is about half the price of tannic acid, while its results are similar in every respect, except one, viz. : it requires no tin or other ingredient to work with, or brighten it for anilines. It is a much brighter and cleaner mordant than sumac, and has none of the disadvantages of stannate of soda ; indeed, it strengthens the work rather than otherwise. It is twice as cheap as methylated spirits, it works evenly, and requires no rinsing. Goods can be mordanted with it in from five to fifteen minutes. It is chiefly recommended for red, violet, brown, green, slate greys, &c., on cotton or mixed goods. The inventor is a practical dyer, we believe, and supplies printed instructions, and may be communicated with on any point relative to his invention. Some of the largest firms in the north have for some time past been extensively using it.

"Some think it a saving to use half the quantity of tannic or aniline mordant, and about three times its weight of glycerine ; others use two parts of mordant and two parts of best starch ;

whilst others still recommend to mordant in a prepared oil bath; and others consider oil and glycerine combined to be an improvement."—*Chemical Review.*

155.—Steam Dyeing by Job Dyers.

Does it pay? Much may be said *pro* and *con.* I have had an opportunity of testing the fire and steam way, and should certainly recommend the steam where more than three hands are kept on, but not for any less number.

156.—To Soften Skins.

Soak the skins in a mixture of two quarts of bran and one gallon of water for three days, take them out and rub them with a handful of salt (if they have hair or wool on add powdered alum with the salt), and hang up to dry. When done in this manner they become as soft as kid.

157.—Paint and Tar—to Extract.

Benzoline is no doubt as good a solvent as can be found If woollen goods, moisten the spot, then rub, then moisten and again rub until out; for silk, lay it on a tea tray and sponge it out, or use a hand brush if there is much on the garment; it may be first plastered over with fresh butter or lard to soften it. Spirits of wine or methylated spirit is used by some in lieu of benzoline.

158.—Wax Tallow Spots—to Extract.

Dip in benzoline, and rub them, they will quickly disappear.

159.—Black Mordant.

40 Gallons of Water
2lb. of Copperas.
½lb. of Argol.
2oz. Blue Stone.

Dissolve separately, and let it settle.

160.—The New Colours of Croissant and Bretonniere.

The colours of croissant and bretonnière give all grey, yellow, and brown shades, up to the deepest black brown. It has not been possible hitherto to produce, on this principle, reds, blues, and greens, though some of the shades have a reddish and a lilac reflection. Their property of requiring no mordant is of

special importance. They impart additional features to certain fugitive colours, especially to the anilines. They resist acids and acid salts, and are not attacked by hot soda-lye, by air or light. They dissolve readily either in water or spirit, and even in a dilute state they work on both to animal and vegetable fibres more readily than any other colour. Mixed goods of woollen and cotton, silk and cotton, and even those containing linen, can be dyed in one operation perfectly even, and free from a checky appearance, as readily as those consisting of one material. Yarns do not require to be moistened before dyeing. To produce a fine grey on 10kilos. of cotton yarn, $\frac{1}{4}$kilo. of colour is sufficient; the cost of which is about $7\frac{1}{4}$d. No additional plant and no novel manipulations are required. The yarn or cloth is entered dry, and worked in the ordinary manner for half an hour. It is then placed in a chrome bath at 80°—90° C., and worked for fifteen minutes. It is then taken out, washed in clear water, and passed through a beck of boiling soda-lye. Other metallic salts may be used instead of chrome, with a view to modify the tone. Wool and silk must be finally passed through a bath of water containing a little acetic acid to neutralise the soda. For medium shades, 80 litres of water $\frac{1}{2}$kilo. of bichrome may be taken for the fixing beck, and 9 litres water and 100 grams soda for the alkaline beck.

At Mulhouse, a select committee has been for some months engaged in investigating these colours. Their remarkable fastness first attracted attention. Thus ink-stains can be removed by oxalic acid from cloth dyed with these colours without affecting the dye. The chemists of the committee prepared samples of the colours, and convinced themselves of the certainty and regularity of the process. In dyeing, it is not necessary to use hot water, as the colours dissolve easily in cold water, and attach themselves to the fibre; but it is better, in practice, to work at 60° C. The colours work on to the fibre very easily, and are not affected by imperfect bleaching or dirtiness of the material.

Sunlight has very little effect upon the colours. During the time that the experiments of the committee were continued, no change was produced either by sun or air. Boiling soap-lyes have scarcely any action, oxalic acid has no effect, but chlorine discharges them. The opinion of the commissioners was that the shades of the new colours could, indeed, be produced of dye-wares previously known, but that the former

had the advantage in ease of application, in cheapness, and in fastness.

Printing experiments were made with four different colours; first, with colour thickened with dextrin and gum tragacanth, and then with a precipitated colour. The latter is produced by means of acids. The soda salts are washed out with warm water, and caustic soda is then added, which partly dissolves the colours, and makes the fixation perfect. Whichever method is used, the colour is chiefly fixed in the very act of printing. The pieces are then steamed, and a passage through the bichromate beck is not necessary. By combining a dyed ground with printed shades, patterns of two or three colours are produced, which are distinguished by great permanence. The printed patterns are very fine, and give the hope of producing, by means of these colours, certain effects hitherto not obtained by the Jacquard loom.

161.—Substitute for Cream of Tartar.

A mixture of 30 parts glauber salts with 20 parts of sulphate of zinc will be in many cases an excellent substitute for cream of tartar.

162.—Mordant in lieu of Tartar in Wool-Dyeing with Two Salts.

The following mixtures are employed :—

No. 1.—Alum,	10	kilogs.
Water,	10	litres.
No. 2.—Oxalic Acid,	3·5	kilogs.
Water,	2·0	litres.
No. 3.—Acetic Acid,	2	kilogs.

These three liquors are then mixed together, producing a mixture, which only costs 0·16 franc (nearly $1\frac{3}{4}$d.), the litre, or about half the price of the ordinary tartar bath.

163.—Solution of Tin for General Purposes.

Nine quarts muriatic acid, one quart nitric acid, give as much tin as it will take.

164.—Muriate of Tin.

Same as No. 163, without the nitric acid.

165.—Double Muriate of Tin.

Take muriatic acid in a strong stone pot, and in a warm place, gradually feed it with as much tin as it will take, which should be at least 3oz. to the lb., suitable for cotton.

166.—Crimson Spirit.

3 quarts nitric acid, 5 quarts muriatic acid, 1lb. saltpetre, give as much tin as it will take.

NOTE.—If not convenient to make your own spirits I can with confidence recommend the use of solution of tin as bought from Mr. J. K. Archer, of Liverpool.

167.—Lac Scarlet Spirit.

3galls. muriatic acid, 1gall. nitric, 2galls. water; kill with 6lbs. of tin.

168.—Sulphate of Iron.

As recommended for aniline patent mordant. Gradually dissolve 4lb. copperas in 5lb. nitric acid; then add 2 galls. of water. One quart of this to 30 galls. of water (as a stock tub) will produce good results by adding to it from time to time. Next to no inconvenience is occasioned in the making of this, as it does not fume like nitrate of iron.

169.—Nitrate of Iron.

Two galls. aquafortis, 5½lb. old iron hoop with the rust beaten off; add the iron by degrees, after putting the above into a six-gallon pot (stoneware). In cold weather it will be required to be kept warm.

170.—Scarlet Spirits.

3lb. muriatic acid, 3lb. pure double nitric acid; add 2oz. salammonia, and feed with 1½lb. granulated tin.

171.—Scarlet Spirits.

Put any quantity of nitric acid, and the same of clear water, into a stoneware pot, the water first; then add 1lb. of muriatic acid to every 5lb. of the above, and give 2oz. of tin to the lb. of spirits; add it very slowly for two or three days, otherwise it may fire, which would precipitate the nitric acid, when you would lose the spirit.

172.—Starch—Valuable to Fix Colours.

All loose colours, especially anilines on mixed goods, should be punched in a clear well-strained starch liquor; it fixes the colour, and gives substance to the goods.

173.—Good Blacks from Bad Ones.

Mixed goods, when dyed, are often found to be rusty from excess of dye. Take such and handle them in a boiling-hot starch liquor for ten or fifteen minutes, say 1lb. to twelve dresses or 1,000 yards of stuff; this takes off the rust, brightens the black, strengthens the material, and fixes the dye.

174.—Stiffening Silks.

All light silks are better finished up with half gum and half glycerine; it gives body and brilliancy, and has not the unpleasant rattle of glue. Black silks may with advantage be finished in the same way.

175.—Rusty Silks, to Improve.

Job dyers having to contend with old, different colours, and plaid silks, often find, when they are dyed, that some are too bronzed or rusty to finish. Passing them through oil soap hot, and not rinsing them, but drying them open, has a good effect. Another way is to pass them through a little sour, and rinse; or they may be finished with new milk.

176.—Hydrometer Tables.

Baumé's scale for liquids heavier than water is graduated from 0° to 72°. Its relation to direct specific gravity is shewn in the following table :—

0°	= 1·000	27°	= 1·216	51°	= 1·505
3	1·020	30	1·246	54	1·551
6	1·041	33	1·277	57	1·600
9	1·063	36	1·310	60	1·652
12	1·086	39	1·345	63	1·708
15	1·109	42	1·382	66	1·767
18	1·134	45	1·421	69	1·831
21	1·160	48	1·462	72	1·900
24	1·188				

The scale for liquids lighter than water extends from 10° to 40°, the lowest number representing the specific gravity of water, and the higher ones those of lighter liquids.

10°	= 1·000	21°	= 0·930	31°	= 0·874
11	0·993	22	0·924	32	0·869
12	0·986	23	0·918	33	0·864
13	0·980	24	0·913	34	0·859
14	0·973	25	0·907	35	0·854
15	0·967	26	0·901	36	0·849
16	0·960	27	0·896	37	0·844
17	0·954	28	0·890	38	0·839
18	0·948	29	0·885	39	0·834
19	0·942	30	0·880	40	0·830
20	0·936				

Beck's scale, for liquids heavier than water, runs from 1°, which is slightly above the specific gravity of water, to 70°. It is a most inconvenient scale.

1°	= 1·0059	25°	= 1·1724	48°	= 1·3934
2	1·0119	26	1·1806	49	1·4050
3	1·0180	27	1·1888	50	1·4167
4	1·0241	28	1·1972	51	1·4286
5	1·0303	29	1·2057	52	1·4407
6	1·0366	30	1·2143	53	1·4530
7	1·0429	31	1·2230	54	1·4655
8	1·0494	32	1·2319	55	1·4783
9	1·0559	33	1·2409	56	1·4912
10	1·0625	34	1·2500	57	1·5044
11	1·0692	35	1·2593	58	1·5179
12	1·0759	36	1·2687	59	1·5315
13	1·0828	37	1·2782	60	1·5454
14	1·0897	38	1·2879	61	1·5596
15	1·0968	39	1·2977	62	1·5741
16	1·1039	40	1·3077	63	1·5888
17	1·1111	41	1·3178	64	1·6038
18	1·1184	42	1.3281	65	1·6190
19	1·1258	43	1·3386	66	1·6346
20	1·1333	44	1·3492	67	1·6505
21	1·1409	45	1·3600	68	1·6667
22	1·1486	46	1·3710	69	1·6832
23	1·1565	47	1·3821	70	1·7000
24	1·1644				

Cartier's scale for liquids lighter than water runs from 10° = water to 44°. Its relation to direct specific gravity is shown in the following table :—

10°	= 1·000	22°	= 0·916	34°	= 0·845
11	0·992	23	0·909	35	0·840
12	0·985	24	0·903	36	0·835
13	0·977	25	0·897	37	0·830
14	0·970	26	0·891	38	0·825
15	0·963	27	0·885	39	0·819
16	0·956	28	0·879	40	0·814
17	0·949	29	0·872	41	0·809
18	0·942	30	0·867	42	0·804
19	0·935	31	0·862	43	0·799
20	0·929	32	0·856	44	0·794
21	0·922	33	0·851		

The direct scale of specific gravity assumes water to be 1, or 1·000, all heavier liquids requiring larger numbers, and all lighter ones numbers smaller than unity. This scale shows at once the weight per gallon of any liquid, the two first figures to the left hand representing pounds (avoirdupois), and the two or more following to the right being decimal fractions of a pound. Thus, if a sample of double muriate marks 1·450, a gallon of it weighs 14½lb.

Twaddle's scale makes water = 0, and the strongest oil of vitriol = 170°. Unlike direct specific gravity, it extends only to liquids heavier than water. For greater accuracy, the scale is arranged on a set of six instruments, numbered progressively upwards. Thus a No. 1 Twaddle ranges from 0° to 32°.

The relation between Twaddle's scale and direct specific gravity is very simple. To convert a degree of Twaddle into the corresponding degree of direct specific gravity, multiply by 5, and add 1·000 to the product. Thus, if a bleaching liquor marks 7° Twaddle, its specific gravity is—

7
5
—
35
1·000
———
1·035

A sample of single aquafortis marks 33° Twaddle. Its specific gravity is then—

33
5
———
·165
1·000
———
1·165

If the specific gravity has been taken, the degree of Twaddle may be found by reversing this rule, substracting 1·000 and dividing the remainder by 5. Thus, a sample of double aquafortis marks specific gravity 1·350. Its degree on Twaddle's scale will be—

1·350
1·000
———
5) ·350
———
70° Twaddle.

In some hydrometers, graduated for direct specific gravity, the first figure is omitted. On such, water marks 0°, and the above-mentioned sample of double aquafortis 350°. A peculiar hydrometer—called the ammonia glass, or ammonia meter—is used in some districts for the sale of ammonia. It ranges from 10° (water) to 45°, representing the lightest liquors. It very nearly agrees with Baumé's light glass. Hydrometers give inaccurate results if applied to—

a. Hot liquids.

b. Glutinous liquids, solutions of gum, starch, size, &c.

c. Effervescing liquids.

d. Liquids holding solid matters in suspension.

Hot liquids should be allowed to cool, or, if it be necessary to observe their specific gravity at elevated temperatures, a comparative trial should be made on the liquid while hot, and on a portion when cold, so that the indication may be corrected. If it be needful to take the specific gravity of any liquid coming under the heads *b*, *c*, and *d*, a gallon should be accurately weighed.

In chemical, dye, and print works, where hydrometers are placed in the hands of foremen for frequent use, they should be regularly brought at some stated time to the laboratory for verification.

176A.—Comparison of the Degrees of Baume's and Twaddle's Hydrometers, with Specific Gravities.

The specific gravity of liquids is generally noted on the Continent for liquids heavier than water by Baume's hydrometer, while for liquids lighter than water that of Cartier is mostly employed.

These various scales may be, by certain formulas, converted into each other, but, as practical men generally do not like to trouble themselves with long calculations, but want for their experiments everything as far as possible at their hand, it was thought advisable to give, in the following, these comparative scales in full for liquids heavier than water :—

Baumé.	Specific Gravity.	Twaddle.	Baumé.	Specific Gravity.	Twaddle.
0	1·000	0	39	1·345	69
1	1·007	1·4	40	1·357	71·4
2	1·013	2·6	41	1·369	73·8
3	1·020	4	42	1·381	76·2
4	1·027	5·4	43	1·395	79
5	1·034	6·8	44	1·407	81.4
6	1·041	8·2	45	1·420	84
7	1·048	9·6	46	1·434	86·8
8	1·056	11.2	47	1·448	89.6
9	1·063	12·6	48	1·462	92·4
10	1·070	14	49	1·476	95·2
11	1·078	15·6	50	1·490	98.
12	1·085	17	51	1·495	99·
13	1·094	18·8	52	1·520	104·
14	1·101	20·2	53	1·535	107·
15	1·109	21·8	54	1·551	110·2
16	1·118	23·6	55	1·567	113·4
17	1·126	25·2	56	1·583	116·6
18	1·134	26·8	57	1·600	120
19	1·143	28·6	58	1·617	123·4
20	1·152	30·4	59	1·634	126·8
21	1·160	32	60	1·652	130·4
22	1·169	33·8	61	1·670	134
23	1·178	35·6	62	1·689	137·8
24	1·188	37·6	63	1·708	141·6
25	1·197	39·4	64	1·727	145·4
26	1·206	41·2	65	1·747	149·4
27	1·216	43·2	66	1·767	153·4
28	1·225	45	67	1·788	157·6
29	1·235	47	68	1·809	161·8
30	1·245	49	69	1·831	166·2
31	1·256	51·2	70	1·854	170·8
32	1·267	53·4	71	1·877	175·4
33	1·277	55·4	72	1·900	180
34	1·288	57·6	73	1·944	188·8
35	1·299	59·8	74	1·949	189·8
36	1.310	62	75	1·974	194·8
37	1·321	64·2	76	2·000	200
38	1·333	66·6			

From the specific gravity of a liquid given in the above table its weight per gallon may be easily calculated, as the two first figures from the left-hand stand for pounds, while the next preceding ones givethe decimal fractions of a pound; for instance, if the specific gravity of hydrochloric acid is 1·160, a gallon of it will weigh 11·6, or rather more than 11½lbs.

Now a few words about the use of the hydrometer may not be out of place. As important as the gauge glasses are, still, among practical men in this country, they are frequently misused. First of all the hydrometer of whatever scale it may be ought never to be used for hot liquids; it is useless for liquids which contain solid matter in suspension, and also for liquids of a sticky nature. Further, the hydrometer never gives a proof of the superiority of one liquid over the other (as long as equal purity has not been previously shown), but merely its specific gravity; hence, if we meet one liquid marking heavier on Twaddle than another, this would be no proof that the former is more valuable, as for instance, hydrochloric acid, standing 34° F., may be under some circumstances inferior to one standing 26°. Lastly, before using, the hydrometer ought to be quite dry.

177.—Thermometer Scales.

To convert Centigrade (Celsius) *into Fahrenheit.*—If the temperature be above the freezing point of water (32° F. = 0°C.), multiply by 9, divide by 5, and add 32 to the quotient. If it be below freezing point (32° F. = 0° C.), but above 0° F. (= − 18° C.) multiply by 9, divide by 5, and subtract the result from 32°. If below − 18° C. (= 0° F.), multiply by 9, divide by 5, and subtract 32° from the result.

Reaumur's scale, in which the boiling point of water is made 80°, and the freezing point, as in the Centigrade, 0°, is still used in many German dye and print works.

To convert Reaumur into Centigrade, whether above or below freezing point, multiply by 5 and divide by 4.

To convert Centigrade into Reaumur, multiply by 4 and divide by 5.

To convert Reaumur into Fahrenheit, or *vice versâ,* the rules above given for the conversion of Centigrade into Fahrenheit, &c., will apply, 4 being used respectively as multiplier or divisor instead of 5.

177a.—Comparison of the Degrees of Fahrenheit, Celsius, and Reaumur Thermometers.

The difference in the scales of the general thermometers in use is frequently a mystery to practical men. Why the degrees as shown on Fahrenheit's, Centigrade, or Réaumur's ther-

mometers should be different they cannot well conceive when they come to think about them. It may, therefore, be interesting to explain this matter.

In all thermometers, whether made after the system of Fahrenheit, Celsius, or Réaumur, the degrees commence at a point called zero, which always indicates a great degree of cold, and rise to warmer points with varying degrees of rapidity. Celsius and Réaumur commenced at the freezing point of water, and called this zero, and made respectively 100 and 80 degrees between this point and the boiling point of water. From the fact that Celsius divided the distance between the freezing and the boiling points of water into 100 degrees, his thermometer has been called the Centigrade, and has come into general use in France, where the decimal system has found so much favour.

Into all the facts respecting the gradation of thermometers it is unnecessary to enter, suffice to say that investigations which have been most carefully made show the natural zero of Fahrenheit's scale to be—461° 2′, Centigrade – 274°, and Réaumur's – 219° 2′. These remarks show the difference between the scales of each thermometer, and the systems on which they are constructed.

For all ordinary purposes experience has shown that the scale of Fahrenheit is to be preferred to that of the Centrigade, from the fact that each degree indicates a much smaller range of temperature.

Fahrenheit.	Celsius or Centigrade.	Réaumer.	Fahrenheit.	Celsius or Centigrade.	Réaumer.
+212	+100	+80	+198	+92,22	+73,78
211	99,44	79,56	197	91,67	73,33
210	98,89	79,11	196	91,11	72,89
209	98,33	78,67	195	90,55	72,44
208	97,78	78,22	194	90	72
207	97,22	77,78	193	89,44	71,56
206	96,67	77,33	192	88,89	71,11
205	96,11	76,89	191	88,33	70,67
204	95,55	76,44	190	87,78	70,22
203	95	76	189	87,22	69,78
202	94,44	75,56	188	86,67	69,33
201	93,89	75,11	187	86,11	68,89
200	93,33	74,67	186	85,55	68,44
199	92,78	74,22	185	85	68

Fahrenheit.	Celsius or Centigrade.	Réaumer.	Fahrenheit.	Celsius or Centigrade.	Réaumer.
+184	+84,44	+67,56	+138	+58,89	+47,11
183	83,89	67,11	137	58,33	46,67
182	83,33	66,67	136	57,78	46,22
181	82,78	66,22	135	57,22	45,78
180	82,22	65,78	134	56,67	45,33
179	81,67	65,33	133	56,11	44,89
178	81,11	64,89	132	55,55	44,44
177	80,55	64,44	131	55	44
176	80	64	130	54,44	43,56
175	79,44	63,56	129	33,89	43,11
174	78,89	63,11	128	53,33	42,67
173	78,33	62,67	127	52,78	42,22
172	77,78	62,22	126	52,22	41,78
171	77,22	61,78	125	51,67	41,33
170	76,67	61,33	124	51,11	40,89
169	76,11	60,89	123	50,55	40,44
168	75,55	60,44	122	50	40
167	75	60	121	49,44	39,56
166	74,44	59,56	120	48,89	39,11
165	73,89	59,11	119	48,33	38,67
164	73,33	58,67	118	47,78	38,22
163	72,78	58,22	117	47,22	37,78
162	72,22	57,78	116	46,67	37,33
161	71,67	57,33	115	46,11	36,89
160	71,11	56,89	114	45,55	36,44
159	70,55	56,44	113	45	36
158	70	56	112	44,44	35,56
157	69,44	55,56	111	43,89	35,11
156	68,89	55,11	110	43,33	34,67
155	68,33	54,67	109	42,78	34,22
154	67,78	54,22	108	42,22	33,78
153	67,22	53,78	107	41,67	33,38
152	66,67	53,33	106	41.11	32,89
151	66,11	52,89	105	40,55	32,44
150	65,55	52,44	104	40	32
149	65	52	103	39,44	31,56
148	64,44	51,56	102	38,89	31,11
147	63,89	51,11	101	38,33	30,67
146	63,33	50,67	100	37,78	30,22
145	62,78	50,22	99	37,22	29,78
144	62,22	49,78	98	36,67	29,33
143	61,67	49,33	97	36,11	28,89
142	61,11	48,89	96	35,55	28,44
141	60,55	48,44	95	35	28
140	60	48	94	34,44	27,56
139	59,44	47,56	93	33,89	27,11

Fahrenheit.	Celsius or Centigrade.	Réaumer.	Fahrenheit.	Celsius or Centigrade.	Réaumer.
+92	+33,33	+26,67	+46	+7,78	+6,22
91	32,78	26,22	45	7,22	5,78
90	32,22	25,78	44	6,67	5,33
89	31,67	25,33	43	6,11	4,89
88	31,11	24,89	42	5,55	4,44
87	30,55	24,44	41	5	4
86	30	24	40	4,44	3,56
85	29,44	23,56	39	3,89	3,11
84	28,89	23,11	38	3,33	2,67
83	28,33	22,67	37	2,78	2,22
82	27,78	22,22	36	2,22	1,78
81	27,22	21,78	35	1,67	1,33
80	26,67	21,33	34	1,11	0,89
79	26,11	20,89	33	0,55	0,44
78	25,55	20,44	32	0	0
77	25	20	31	−0,55	−0,44
76	24,44	19,56	30	1,11	0,89
75	23,89	19,11	29	1,67	1,33
74	23,33	18,67	28	2,22	1,78
73	22,78	18,22	27	2,78	2,22
72	22,22	17,78	26	3,33	2,67
71	21,67	17,33	25	3,89	3,11
70	21,11	16,89	24	4,44	3,56
69	20,55	16,44	23	5	4
68	20	16	22	5,55	4,44
67	19,44	15,56	21	6,11	4,89
66	18,89	15,11	20	6,67	5,33
65	18,33	14,67	19	7,22	5,78
64	17,78	14,22	18	7,78	6,22
63	17,22	13,78	17	8,33	6,67
62	16,67	13,33	16	8,89	7,11
61	16,11	12,89	15	9,44	7,56
60	15,55	12,44	14	10	8
59	15	12	13	10,55	8,44
58	14,44	11,56	12	11,11	8,89
57	13,89	11,11	11	11,67	9,33
56	13,33	10,67	10	12,22	9,78
55	12,78	10,22	9	12,78	10,22
54	12,22	9,78	8	13,33	10,67
53	11,67	9,33	7	13,89	11,11
52	11,11	8,89	6	14,44	11,56
51	10,55	8,44	5	15	12
60	10	8	4	15,55	12,44
49	9,44	7,56	3	16,11	12,89
48	8,89	7,11	2	16,67	13,33
47	8,33	6,67	1	17,22	13,78

Fahrenheit.	Celsius or Centigrade.	Réaumer.	Fahrenheit.	Celsius or Centigrade.	Réaumer.
−0	−17,78	−14,22	−21	−29,44	−23,56
1	18,33	14,67	22	30	24
2	18,89	15,11	23	30,55	24,44
3	19,44	15,56	24	31,11	24,89
4	20	16	25	31,67	25,33
5	20,55	16,44	26	32,22	25,78
6	21,11	16,89	27	32,78	26,22
7	21,67	17,33	28	33,33	26,67
8	22,22	17,78	29	33,89	27,11
9	22,78	18,22	30	34,44	27,56
10	23,33	18,67	31	35	28
11	23,89	19,11	32	35,55	28,44
12	24,44	19,56	33	36,11	28,89
13	25	20	34	36,67	29,33
14	25,55	20,44	35	37,22	28,78
15	26,11	20,89	36	37,78	30,22
16	26,67	21,33	37	38,33	30,67
17	27,22	21,78	38	38,89	31,11
18	27,78	22,22	39	39,44	31,56
19	28,33	22,67	40	40	32
20	28,89	23,11			

178.—French Measure of Capacity.

		Eng. cubic in.	
Millilitre		·061028	
Centilitre		·61028	
Decilitre		6·1028	
		Imp. Measure	
		gal.	pint.
*Litre	=	0	1·76
Decalitre	=	2	1·60
Hecatolitre	=	22	0·08
Kilolitre	=	220	0·80
Myriolitre	=	2201	

* A cubic decimetre.

French Measure of Weight.

		Eng. grains.			
Milligramme		·0154			
Centigramme		·1544			
Decigramme		1·5444			
		Troy Weight.			
		lb.	oz.	dwts.	grs.
†Gramme		15·4440			
Decagramme	=	0	0	6	10·44
Hecatogramme	=	0	3	4	8·4
Kilogramme	=	2	8	3	12·02
Myriogramme	=	26	9	15	0·24

A kilogramme is 2¼lb. avoirdupois.

† A gramme is the weight of a cubic centimetre of water.

179.—On the Dyeing of Kid Gloves.

The dye solutions are brushed over a glove drawn smoothly over a wooden hand. In order to dye black, the glove is brushed after washing it with alcohol, dried and brushed with a decoction of logwood, left for ten minutes, and brushed over once more with logwood. After ten minutes the glove is dipped into a solution of sulphate of iron, and brushed afterwards with warm water. If the colour is not dark enough, add a little fustic or decoction of quercitron in the logwood bath. In place of the sulphate of iron the nitrate may be better employed. When the glove begins to dry, it is rubbed with a little Provence oil and talcum, laid between flannel and pressed. It is then rubbed again with oil and talcum, and drawn on a wooden hand. The glove must not get black on the inside, consequently none of the dye fluid should reach the inside of the glove. Brown is dyed by brushing on a decoction of fustic, red, redwood, and logwood, with a little alum. The quantities of dye stuff to be used are regulated according to the tints. For darkening the colour a small quantity of solution of sulphate of iron is used. Morocco red is produced by brushing on a decoction of cochineal, to which a little salt of tin and oxalic acid is added. The tint is easily made darker by adding a little logwood. Grey is produced by brushing on a decoction of sumac, and subsequent treatment with a weak solution of sulphate of iron; greenish grey by the addition of fustic and logwood, also fustic and indigo-carmine to the decoction of sumac. The aniline colours all fix themselves without any further addition, by brushing their solutions on the glove. In place of the brush a sponge may be used where it seems suitable. In order to give black a pleasing bluish appearance, after the dyeing it may be washed with a little sal ammoniac. Should the seams in the gloves remain white after dyeing, they are coated with a paste in which a little fat is put.

180.—To Dye Kid Leather Black.

Saturate a diluted solution of bichromate of potash with potash until the solution appears slightly orange, nearly pure orange. This solution is to be applied on that side of the leather you want to dye black. Boil 4lb. of logwood, 4lb. of fustic powder, and 3lb. of fustic chips, in five gallons of water; decant the liquor from this bath, and apply it carefully on the leather, afterwards treat it with the above bichromate of potash

solution until it is quite a deep black. The leather is to be left to drain for a few hours, afterwards to be put in a bath, which is prepared by dissolving equal parts of good soap in water, to which you have added about two-third parts of weight of oil, which will soften and give it at the same time a nice bright black appearance. Gloves can be dyed black by this process.

181.—Discharge of Aniline Dyes.

The best solution for discharging hydrogen is tin salt (protochloride of tin), but it is important that it is of good and pure quality. This solution of tin salt is to be put in an earthenware mug, in which it is to be diluted with water until it stands at about from 1° to 2° Bé.; then a small quantity of tin foil is to be added. In this liquor the article which has to be discharged of its colour (previously well cleaned from grease, &c.), is to be put. The mug has to be covered and heated in a vessel which contains hot water. From time to time it is necessary to look how far the discharge has taken place, and as soon as it is satisfactory the article is to be taken out and washed in water; for woollen goods it is essential to use warm water. According to Dr. Reimann's experience, it is best to leave the article in the hot tin liquor for about a quarter to half an hour, and to remove it as soon as the same is cold. After this time the colour is generally all gone. It is not advisable to employ the heat much longer. There are sometimes cases where the tin salt does not completely remove the colour; under these circumstances cyanide of potassium may be employed, but only when absolutely requisite. But as the use of cyanide of potassium for discharging aniline colours has been well known by a great many dyers in this country for some time, and as the same is such a powerful poison that its use is connected with the greatest danger to the working people, notwithstanding all precautions, the use of it is not recommended.

182.—Good Brown for Straw Hats.

For one dozen, take 1lb. of soda, dissolved in boiling water, and let them lie in this until they turn a dark yellow, then lift, and in another vessel dissolve 4oz. green copperas in boiling water. Let them lie in this from ten to fifteen minutes, handling them all the time; take them out and give them a warm water, and they are finished. The chemical action of

soda and copperas producing either light or dark results, as required. They are satisfactory and stand well.

183.—To Remove Nitrate of Silver Stains from Woollens or Linen Cloths of any Kind.

Iodine ..... 1 drachm.
Iodine of Potassium, 1 oz.

Mix; dab the stain with the above mixture, and in about half a minute wash with 1oz. of cyanide of potassium in 5oz. of water.

184.—Ammonia Paste.

Strong Ammonia ..... 1 quart.
Water ..... 1 quart.
Ground Cochineal..... 2lb.

Stir them all well together in a stone pot; tie up the mouth of it tightly, and set it to work in a warm place for two days, when it will be fit for use.

185.—Antidote to Moths in Cushions, Furs, &c.

In order to protect upholstery from the ravages of moths, the best remedy consists in an addition of fresh-blown hemp to the upholstery material. For this purpose the hemp is gathered at the beginning of July, dried quickly in the shade, and added to seaweed, horsehair, and the like. A single stem (with leaves and blossoms) suffices to protect a carriage cushion for a year from this vermin. Even upholstered articles, in which moths have already settled, may, in this way, with occasional repairs, be thoroughly freed from these injurious insects.

In order to render the hemp available at every season, it is only necessary to make a store in the summer, and preserve it carefully dried. This is most effectually done in pinewood casks, provided with covers, and placed in a dry store-room. In the making-up of new cushions the following process is also recommended: The feather pillows of the seat are covered over with canvas, on which is laid a thick layer of about 18 millimetres of cotton wool, over which is laid another canvas, and lastly the loose cushion cover. The use of hemp is, however, preferable to the latter process. In all cases, however, a regular thorough cleansing is indispensable.

186.—To Prevent Gum from becoming Mouldy.

Moisten the gum with alcohol, then dissolve it in water, and add a few drops of sulphuric acid. After the deposition of the precipitated calcic sulphate a perfectly colourless solution of gum is obtained, even when inferior kinds of gum are used.

187.—New Method for Dyeing Shots.

When satins, satinets, sarsenets, or silks of any kind are found to contain shots—that is, warp and weft of different qualities—they must be prepared as follows :—

For 100 yards. Dissolve 1½lb. salt of tartar, in a copper containing 150 gallons boiling water ; winch in this one hour ; lift, and wash in two waters ; and then prepare for any colour. If, after dyeing black, brown, or any colour, the silk is found to contain a shot of different silk, it must be discharged to the bottom, and put through the stuff as directed above ; then prepare anew for whatever colour required.

188.—Acetate of Iron.

Dissolve 10lb. of acetate of lime in 15 gallons of water ; then add to it gradually a solution of copperas (sulphate of iron) as long as any precipitate is perceivable. The clear liquor is the acetate of iron. The precipitate may be washed out once or twice with water, and this wash-water mixed with the first acetate of iron. This method is intended for consumers.

189.—Pyrolignite of Iron.

Dissolve 10lb. of pyrolignite of lime in 15 gallons of water, and proceed in the same way as with the acetate of iron. This method is intended for consumers.

190.—Waterproofing Linen and Cotton Fabrics.

According to W. Greene, fabrics of linen, or cotton, can be rendered waterproof by saturating them with a solution of gum or gelatine, containing from $\frac{1}{10}$ to $\frac{1}{50}$ of bichromate of potash, and then exposing them to sunlight. The gelatine becomes insoluble and firmly fixed to the cloth.

191.—Directions for Rendering Woollen Materials Waterproof.

Allow one quarter of a pound of white Marseilles soap to boil in 12 litres of water, and dissolve, on the other hand, 165 grms.

of alum in 12 litres of water. Heat both of these solutions to 70° Réaumur. Let the stuff then pass several times through the soap bath, drawing it afterwards through the solution of alum, and dry it in the air.

192.—To Render Cloth and other materials Impervious to Water.

Use the following mixture:—

150 grms. of Borax.
1000 grms. of Isinglass.
30 grms. of Sago.
20 grms. of Salep.
150 grms. of Stearine.
10 litres of Water.

The following is also a recipe for the same purpose: Dissolve 150 grms. of alum in 3 litres of water at 66° Réaumur; and, on the other hand, 645 grms. of sugar of lead in $1\frac{1}{2}$ litres of water at 55° Réaumur. Pour off both solutions, stirring them well together; allow the precipitate which forms to deposit itself, and then pour off the clear fluid carefully. The material to be rendered waterproof is to be steeped for twenty-four hours in the above fluid at the ordinary temperature, after which it is dried. It is then free from all smell, and will preserve its original softness of texture perfectly.

A far better result is produced by passing the material to be treated through a revolving cylinder containing a solution of sugar of lead, then squeezing it nearly dry by wringing, placing it afterwards in another vessel that contains a solution of sulphate of alumina, wringing it out a second time, and allowing it to dry. The cloth is then rubbed and beaten till no residue of the white precipitate which had formed upon its surface is any longer visible. In the pores of the material sulphate of lead will then be found in very fine particles, which will prevent the penetration of water, but not of air.

193.—Impregnation with Indiarubber.

Mix intimately together 30 grms. of alumina with a concentrated solution of indiarubber with oil of turpentine, and paint the mixture upon the cloth, well stretched upon a table, when it is allowed to dry. The thickness of the indiarubber coating will vary according to the number of strokes it receives

from the brush. If the side not prepared with indiarubber is in any way altered, clean it with alcohol.

194.—**Impenetrable Double Cloth.**

The chief peculiarity of this stuff is the close union of two materials which, without being impermeable to air, may be rendered waterproof by any of the mixtures already mentioned, or by means of the following preparation :—

9 litres of water,
625grms. of Powdered Alum, and
500grms. of White Lead.

When these substances have been sufficiently worked together, the clean fluid on the top is drawn off, and the cloth steeped in until it is thoroughly saturated with liquor. Afterwards it passes through soap, and is then washed and dried, when it will be ready for the indiarubber treatment, which is carried on thus: The solution of india-rubber is laid on the cloth in slanting lines, and similar lines are formed on the cloth that is to be placed over it, but the latter, when the two cloths have been laid the one upon the other, cut the lines of the former at right angles. By this means small squares are formed which, from their transparency, allow the free passage of steam and air, whilst moisture and rain cannot penetrate the double prepared cloth.

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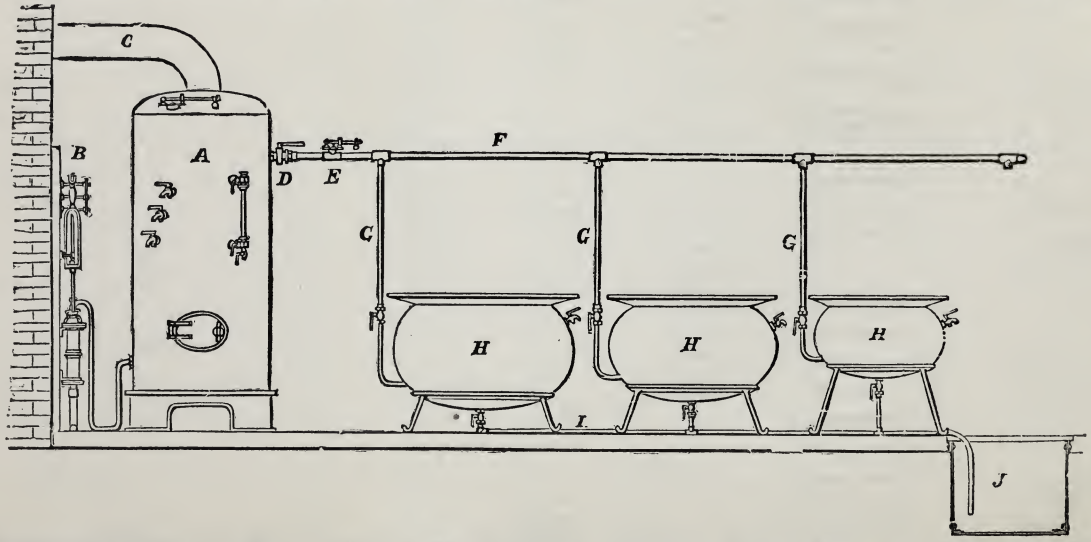

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Fustic 47 % „ 84s. „	9d. „
Indigo Paste, "acid"	8d. „
„ „ "free"	8½d. „
„ Powder (Soluble in Water)	16s. ℔ lb., 1s. 6d. ℔ oz.
Safflower (Carmine)	1s. 3d. ℔ oz., 20s. ℔ bottle.
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ANILINE DYE POWDERS AND CRYSTALS.

Per oz.		Per lb.
1/2 Magenta	A	10/- & 12/-
2/- Purple	B	20/- & 30/-
1/- Pink	C	16/-
1/2 Roseine	D	14/-
2/- Ponceau	E	24/-
1/6 Black	E	20/-
2/- Mauve	F	20/- & 30/-
2/- Blue	G	20/- & 30/-
2/- Crimson	H	20/- & 30/-
1/6 Green	I	16/-
1/- Red	K	16/-
1/- Brown	M	12/-
1/- „ No. 2		8/-
2/- Orange	N	24/-
5/- Cerise	O	70/-
1/6 Fuchine	P	16/-
1/- Canary	Q	8/-
2/- Violet, &c.	R	20/- & 30/-
1/- Magenta No. 2		10/-
1/6 Lavender	S	20/-
3/6 Green Brilliantine	T	48/-
1/- Aurine	U	8/-
1/6 Salmon	V	16/-
1/- Marone	W	8/-

Marone or Sultan Crystal, for Wool and Silk.....8/- per lb.

Any quantity less than 1lb. will be charged at the rate of per oz.

A few ounces can be sent by post at a very trifling cost. We do not supply less than one ounce of any of the Dyes. Three-halfpence per ounce to be added for postage, or P.O. Orders must accompany all orders for these Dyes, when they will invariably be sent by return of post, thus obviating delays of Carriers and cost for Bottles, Hampers, &c.

Patent Rights will be Protected.

BY HER MAJESTY'S  ROYAL LETTERS PATENT.

ANILINE MORDANT,

2s. PER POUND.

For Cottons and Mixed Goods it has not its equal. 1 oz. will Mordant a Dress or Twelve Yards of Stuff, with next to no time or trouble, in Pink to Maroon. Greys, Browns, Green, Violet, Claret, &c., without Stannate or Tin Blue, can now be successfully obtained by it, any shade.

Testimonials and Instructions with first Order, or by Post with One Stamp.

☞ See that every packet has the Patent Seal and Name upon it. 1lb. sent as sample on receipt of 2s. 6d. in Stamps, carriage paid.

F. J. BIRD,

INVENTOR AND SOLE MANUFACTURER.

Works—Lansdown, Stroud, Gloucestershire.

Put up in 1 lb. to 28 lb. Packets. Carriage Paid on 10 lbs. and upwards to all parts of England on receipt of 20s.

Drysalters and Large Consumers liberally treated with.

No Colourable Imitation allowed.